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EXPERIMENTAL VARIATION OF THE UREA CONTENT OF THE BLOOD.

By E. B. DREVERMANN.[1]

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IN recent years attention has been drawn by several observers[1][2] to the fact that after gastro-intestinal hæmorrhage there is a rise in the blood urea of the patient. The reasons given to explain this rise are concerned both with the formation and with the excretion of urea. It has been suggested: that it occurs because of the absorption and deaminization of that blood which passes down the alimentary canal; that urea excretion is diminished by the compensatory retention of fluid; or that the acute anoxæmia resulting from the hæmorrhage has affected the kidney to such a degree that it is unable to excrete nitrogenous products in sufficient concentration.

The following experiments were carried out in an attempt to determine what part is played by the digestion and absorption of blood from the alimentary canal.

Methods.

The experiments were for the most part carried out upon the author himself, who at the same time was doing duty as a resident medical officer. Two experiments were done upon colleagues.

Blood was obtained from the median cubital vein and estimations of urea were made by McLean's modification of Van Slyke's method. Urinary urea was determined by Dupre's method.

Results.

I. Variation in the Blood Urea Attributable to Change in Diet.

(i) Before an attempt was made to ascertain what part blood, set free in the alimentary canal,

[1] Work carried out under grant from the National Health and Medical Research Council.

might play in the rise in the urea content of the blood, some preliminary observations were made upon the changes in the level of urea in the blood when the subject was on an ordinary diet under normal conditions of work. For comparison another subject was placed on an identical diet, but was at rest in bed. In the first case samples of blood, for estimation of urea, were obtained immediately after the subject's rising and in both cases immediately prior to his taking breakfast. Thereafter they were taken at two-hourly intervals throughout the day. The diet consisted of:

Breakfast: Carbohydrate, 17·5 grammes; protein, 29 grammes; fat, 45·3 grammes.

Dinner: Carbohydrate, 65 grammes; protein, 24·5 grammes; fat, 19·3 grammes.

Tea: Carbohydrate, 76 grammes; protein, 25·5 grammes; fat, 27 grammes.

Supper: Carbohydrate, 9 grammes; protein, 5·5 grammes; fat, 7 grammes.

Dinner was taken at 1 p.m., tea at 5.30 p.m., and supper at 1 a.m. The total caloric value of the diet was 1,895 Calories. The results are set out in Table I.

TABLE I.

Variation of Blood Urea (milligrammes per centum). Subject on Normal Diet.

Time	8.30	10.30	12.30	2.30	4.30	6.30	8.30	10.30	12.30	2.30	4.30	6.30	*Remarks.*
E.B.D. (blood urea)	16	29	39	32	26	29	22	21	18	19	17	16	At work till 1 a.m.
H.B. (blood urea)	16	26	13	17	19	24	18						At rest in bed.
Meals	8.30 Breakfast.		1 p.m. Dinner.			5.30 Tea.			1 a.m. 6 ozs. milk.				

These results show that the urea content of the blood varies greatly throughout the day, both when the subject is at rest and when he is at work. It is seen that a definite rise follows each meal. This rise is better maintained while the subject is at work, but soon falls when the subject is at rest.

Under conditions of work it seems probable that the increased metabolism of tissue protein accounts for the maintenance of the blood urea at the higher level. At rest little tissue protein is used, so that the urea content of the blood falls quickly owing to a diuresis induced by its earlier elevation. Under the conditions of the experiment the fall after breakfast was to a level below that of the fasting blood urea. It was seen, therefore, that the urea content of the blood at any particular time is dependent not only on the time and nature of the previous meal, but on the conditions of work or rest of the subject.

(ii) The effect of a high protein meal was then observed under varying conditions of fluid intake. In each experiment eggs were used as the source of protein. They were boiled hard and then cooled. In each case two eggs were eaten at 8.30 a.m., and then two were eaten at half-hourly intervals until twelve had been consumed, that is, until 11 a.m. In this way approximately 60 grammes of protein were taken in two and a half hours.

In the first experiment [Table II (*a*)] the subject took only sufficient fluid to relieve thirst; in the second [Table II (*b*)] he took two ounces of water at half-hourly intervals for the first two and a half hours, that is, two ounces of water for every two eggs. This amount of fluid was in excess of the amount required to relieve thirst. In the third experiment [Table II (*c*)] loss of fluid was obtained by vigorous exercise and complete abstention from fluids for eighteen hours prior to the ingestion of protein. No fluid was taken at all during the experiment. In this experiment no fluid was taken for thirty-four hours until just after the blood for the final urea estimation had been withdrawn at 12.30 a.m., when a small amount of fluid was taken. After the taking of this fluid there was a feeling of weakness and giddiness. Twelve hours after this the blood urea content was 49 milligrammes per 100 cubic centimetres.

The results set out in Table II show that the ingestion of large quantities of protein cause the blood urea to rise to a high level. When there was no restriction of fluids, the subject taking only that amount of fluid which was demanded by his thirst, the blood urea level rose slowly but steadily. When fluids were restricted in experiment (*c*) the rise was more rapid, but was not so great as in experiment (*a*). The high level was maintained for some time. It seems probable that the protein was absorbed only slowly from the intestine in the absence of sufficient fluid. When fluid was given the protein was absorbed more rapidly, as is indicated by the high blood urea — 49 milligrammes per 100 cubic centimetres—some time afterwards. When excess fluid was taken [experiment (*b*)] absorption and deaminization of protein took place in the normal way, but the diuresis caused by the excess fluid intake aided in the elimination of urea from the blood. These experiments show that the ingestion of large quantities of protein causes a rise in the blood urea. The rapidity and extent of the rise and the maintenance

TABLE II.

Variation of Blood Urea Content (milligrammes per centum) after High Protein Meal. Subject E.B.D.

Time	8.30	9.30	11.30	12.30	1.30	2.30	3.30	4.30	5.30	6.30	7.30	8.30	10.30	12.30	*Conditions.*
Blood urea—															
(*a*)	26	27	28		32		36		39		43				No restriction of fluid.
(*b*)	26			29		36		41		39		35	35	26	Excess fluid.
(*c*)	20			35		34		35		35		33	35		Restriction of fluid.

of blood urea at a high level are dependent in part on the fluid intake. Diuresis caused by the elevation of the blood urea is not alone sufficient to reduce the level of urea in the blood or to cause thirst.

(iii) An attempt was now made to dehydrate the subject to a slight degree by means of vigorous exercise and then to replace the weight of fluid lost by giving protein and fluid in the same proportion as they occur in blood plasma. Both the protein and the fluid were given as milk and eggs. The results obtained are set out in Table III. The fluid taken was slightly in excess of that lost as indicated by the weight. The intake of protein was 90 grammes and of fluid 1,140 cubic centimetres. The blood urea content rose by 22 milligrammes per 100 cubic centimetres, and there was a large output of urea in the urine.

TABLE III.

Variation of Urea Content of the Blood after High Protein Diet. Subject J.H B.

Time.	Exercise.	Nutrition.	Hæmoglobin Percentage.	Blood Urea. (Milligrammes per centum.)	Weight in Kilograms.	Volume Urine in Cubic Centimetres.	Urea Concentration.	Urinary Urea in Grammes.
11.45	Tennis.		100	25	68·8			
1.15		6 eggs; milk, 16 oz.	103	27	67·9	90	1·9	1·71
3.0		4 eggs; milk, 7 oz.						
4.0		2 eggs; milk, 7 oz.						
5.30				32				
8.0		Milk, 7 oz.		42	68·9	225	3·2	7·04
10.0				47		150	3·3	4·95
12.0				42				
2.0				29		150	3·6	5·4
Total						615		17·49

(iv) The variation of the level of the blood urea, when the subject was on a diet containing a minimum amount of protein, was next observed. The diet consisted of sago, tapioca, cornflour and glucose. The caloric value of the diet was 5,000 Calories, half of which was supplied by glucose. Large amounts of fluid were taken as glucose drinks throughout the day. Meals were taken at 8.15 a.m., 1 p.m., and 6 p.m. The total amount of protein was one gramme per day.

The results set out in Table IV show to what extent the normal urea content of the blood is dependent upon a normal diet. All the estimations were considerably below that of the primary fasting level. It is seen that, although there was little protein in the diet, the blood urea varied throughout the day. That this variation was probably due to endogenous protein metabolism during essential activities, is shown by the low values at the end of the fourth day, after the subject had been at rest for some hours.

II. Variation of Urea Content of the Blood after Bleeding and Ingestion of Blood.

In these experiments the effects of bleeding, of the ingestion of blood and of bleeding followed by ingestion of blood were studied in comparison with a control experiment on the same subject. In each of these experiments no food or fluid was taken from midnight on the previous night until the conclusion of that experiment. At 10.30 a.m. the fasting urea content of the blood was determined. Blood urea, urinary urea and volume, hæmoglobin and body weight were then determined at the intervals shown in the table. Table V shows the results: (*a*) of a control experiment, (*b*) after bleeding, (*c*) after ingestion of blood, and (*d*) after bleeding and immediate ingestion of blood. In experiment (*b*) a pint of blood was taken immediately after the first blood sample for the fasting blood urea. It was citrated and stored at 2° C. A week later it was introduced into the duodenum by Rehfuss tube [experiment (*c*)]. During the introduction of blood the subject suffered no nausea, but despite the fact that the blood had been warmed there was a sensation of cold in the pharynx. No nausea or discomfort was experienced until twenty-four hours later, when there was severe colic. This persisted until the bowels were opened by means of an aperient on the third day, resulting in melena which persisted for twenty-four hours.

Three months later, when the subject had returned to normal, an artificial gastro-intestinal hæmorrhage was produced by removal of one pint of blood from the vein and its immediate introduction into the duodenum by Rehfuss tube [experiment (*c*)]. As before, melena and colic followed.

TABLE IV.

Variation of Urea Content of the Blood (Subject E.B.D.) on Carbohydrate Diet.

Day.	1		2						3						4						
Time	8 a.m.	8 p.m.	8 a.m.	12 m.d.	4 p.m.	8 p.m.	12 m.n.	4 a.m.	8 a.m.	12 m.d.	4 p.m.	8 p.m.	12 m.n.	4 a.m.	8 p.m.	12 m.n.	4 a.m.	8 a.m.	12 m.d.	4 p.m.	8 a.m.
Blood urea (milligrammes per centum)	20	15	9	12	11	12	15	14	9	11	8	14	12	11	11	10	15	12	6	6	8

TABLE V.

Variation of the Urea Content of the Blood after Bleeding and Ingestion of Blood. Subject E.B.D.

Time	10.30	11.30	12.0	2.0	4.0	6.0	8.0	Remarks.
Weight in kilograms—								Variation in weight:
(a)	64·3	—	63·8	63·6	63·3	63·2	63·0	−1·3 kilograms.
(b)	61·1	—	60·5	60·4	60·2	60·2	60·0	−1·1 kilograms.
(c)	62·8	—	62·6	62·5	61·6	61·2	61·0	−1·8 kilograms.
(d)	64·0	—	63·6	63·4	63·0	62·6	62·3	−1·7 kilograms.
Hæmoglobin *per centum*								
(a)	—	—	—	—	—	—	—	
(b)	115	—	103	100	100	98	100	
(c)	109	—	—	109	—	109	—	
(d)	103	—	—	98	—	—	—	
Blood urea—								Maximum rise in blood urea:
(a)	32	—	33	33	35	39	38	7 mgm. per 100 c.cm.
(b)	25	23	31	33	36	37	42	17 mgm. per 100 c.cm.
(c)	29	—	29	34	43	47	42	18 mgm. per 100 c.cm.
(d)	35	38	40	45	49	48	52	17 mgm. per 100 c.cm.
Urea concentration—								
(a)	3·1	—	2·7	2·5	2·0	2·6	2·4	
(b)	3·0	—	2·9	3·3	3·8	3·3	3·8	
(c)	2·1	—	0·6	2·6	3·2	2·8	3·3	
(d)	3·1	—	1·8	2·7	3·3	3·7	2·8	
Volume urine—								Total volume:
(a)	—	—	40	52	46	40	43	221
(b)	—	—	45	45	45	45	35	215
(c)	—	—	690	100	90	140	120	1,140
(d)	—	—	145	90	64	64	110	473
Urinary urea—								Total urinary urea:
(a)	—	—	1·06	1·25	1·00	1·04	1·01	5·36
(b)	—	—	1·33	1·48	1·71	1·33	1·31	7·16
(c)	—	—	4·14	2·60	2·88	3·92	3·96	17·50
(d)	—	—	2·54	2·43	2·11	2·37	3·08	12·53

(a). Control.
(b) Removal of one pint of blood.
(c) Ingestion of one pint of blood.
(d) Removal of one pint with ingestion immediately afterwards.

Table V shows that after each of the three experimental procedures there was a greater rise in the urea content of the blood than that which occurred in the control. That there was no defect in the excretory function of the kidney after removal of blood is shown by the high concentration of urea in the urine. The total urea output after the removal of a pint of blood was comparable with that of the control. When blood was ingested [(*c*) and (*d*), Table V] the urea output was much greater, showing that blood proteins had been absorbed from the intestine and subsequently deaminized. A striking diuresis was produced after the ingestion of blood in (*c*) and a slighter diuresis in (*d*). The diuresis in (*c*) was probably related to fluid absorbed from the blood. When the ingestion was preceded immediately by removal of blood, the diuresis was only slight, and the blood urea had probably not reached its maximum level at the end of the experiment. The increase in blood urea caused by the loss and the ingestion of blood in these experiments is not comparable with that which may occur after severe gastro-intestinal hæmorrhage, but in such subjects the amount of blood which passes down the intestine is considerably greater than one pint. Further, some of the blood is usually vomited, so that there is, in addition, actual loss of fluid from the body.

It seems unnecessary to consider the anoxæmic theory to account for the rise in blood urea which follows gastro-intestinal hæmorrhage. In these experiments the slight anæmia resulting from the removal of a pint of blood did not affect kidney function, as is shown by the urea concentration in the urine. It seems probable that in the event of the anæmia affecting urea excretion by the kidney, it would also affect urea formation in the liver. In severe anæmia from causes other than hæmorrhage a rise in blood urea content does not occur.

Conclusions.

1. The blood urea at any particular time is dependent on the previous diet, the fluids taken, and the condition of work or rest under which the blood is taken.

2. The rise in blood urea following a gastro-intestinal hæmorrhage results in part from the formation of urea from blood proteins which are digested in the intestine. The diminished excretion of urea from compensatory retention of fluid also contributes to this effect.

Acknowledgements.

I wish to thank Dr. Ian Wood and Dr. John Bolton for their assistance and advice in the carrying out of these experiments. I am indebted to

Miss Verney South, formerly acting biochemist to the Royal Melbourne Hospital, for carrying out the biochemical tests in most of the experiments.

References.

(1) A. P. Ingegno: "Elevated Blood Urea of Acute Gastro-intestinal Hæmorrhage and its Significance", *The American Journal of the Medical Sciences*, Volume CXC, 1935, page 770.
(2) Ian J. Wood: "Treatment of Hæmorrhage", *The British Medical Journal*, Volume II, 1936, page 115.

PINK DISEASE TREATED BY VITAMIN B_1.[1]

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THE accessory food factors or vitamins have awakened world-wide interest in the last few years. This is due to the dramatic results which have been obtained in certain diseases as a result of treatment with vitamin preparations, to those research workers who have succeeded in isolating and synthesizing some of these substances, and lastly to the manufacturing chemists who have brought them to the notice of the profession. Your daily mail bears witness to the truth of this statement.

The pendulum has swung far, perhaps too far in some directions; but we cannot overlook the obvious effects of vitamin *A* in promoting growth and in protecting against infection, the antirhachitic value of vitamin *D*, and the ascorbic value of vitamin *C*. The wide publicity given to these substances by the daily Press, in which they are vaunted as a panacea for all ills to which human flesh is heir, should not cause us to lose sight of their real value.

Vitamin *B* was one of the latest vitamins to be brought to our notice. Eijkman, of Java, discovered in 1897 that fowls which were fed on polished grain developed symptoms resembling those of beriberi in the human being. The addition of the polishings to the daily rations effectively prevented the onset of these symptoms and cured the fowls already affected. This laid the foundation for the rational treatment of beriberi by the addition of the polishings of the rice to the diet of those natives who largely subsisted on the polished product.

In 1925 Goldberger and Tanner discovered vitamin B_2 as a separate factor,[1] and since then other workers have succeeded in isolating and synthesizing various factors of vitamin *B*. The names given to these factors have been confusing because of their lack of uniformity; but order is gradually developing out of the chaos. I shall attempt to set forth the usually accepted description of these factors in the knowledge that the subject is still in a state of flux, and that further knowledge will probably add to their number and possibly subdivide those already known.

Vitamin B_1, aneurin or thiamin chloride, the antiberiberi and antineuritic factor, is a thermolabile, water-soluble crystalline substance. It was first isolated by Jansen and Donath in the same laboratory in which Eijkman had performed the original work in Java. Its chemical formula was found to be $C_{12}H_{18}ON_4Cl_2S$, and its chemical constitution was elucidated by organic chemists. Williams and Gline succeeded in synthesizing this substance in the laboratory in 1936.

The common natural sources of this substance are yeast, the embryo of cereals, molasses, beef liver and leafy vegetables. Except leaf vegetables very few average diets contain appreciable quantities of these foods. Animals from whose diet this factor has been eliminated develop anorexia, constipation, œdema, tachycardia and muscular weakness progressing to paresis.[2] These are the symptoms of beriberi, and it is now accepted that the symptoms of this disease are due to polyneuritis associated with lack of vitamin B_1.

The pharmacology of vitamin B_1 is incomplete, but it appears to have the following well-authenticated effects: (i) an influence on the physiology of the nervous system;[3] (ii) a growth-promoting effect on the young (this effect is so constant that it is used for standardizing the potency of vitamin B_1 preparations); (iii) an increase in tone in the gastro-intestinal tract;[4] (iv) an increase in the amount of hydrochloric acid in the gastric juice;[4] (v) an influence on carbohydrate metabolism as a coenzyme to carboxylase, an enzyme which acts on pyruvic acid, an intermediate product in the oxidation of glucose;[5] (vi) a hæmatopoietic action;[6] (vii) an increase in the action of acetylcholine,[7] whereby the motor action of the parasympathetic nervous system is enhanced with all that such action implies, including relaxation of arteriolar spasm, relaxation of sphincters, and increase of tone in the hollow visci and in the somatic muscles; (viii) an effect on the water balance of the body.

Major degrees of lack of vitamin B_1 cause beriberi; minor degrees are stated to be very common in civilized communities,[8] and to cause characteristic symptoms affecting the whole organism and the nervous and gastro-intestinal systems in particular.

The minimal requirement of vitamin B_1 for an adult can be calculated from Cowgill's formula:[9]

> Vitamin B_1 (in international units) = 0·00066 × weight in pounds × Calories consumed.

Thus a man weighing 150 pounds and consuming 3,000 Calories per day would require about 300 international units of vitamin B_1, according to this formula.

Vitamin B_2 (riboflavin or lactoflavin) is a yellowish green fluorescent water-soluble pigment, thermostabile in character, found largely in milk, lean beef, liver, eggs, malt, grasses, spinach, wheat germ and dry yeast. It is stated to promote the growth of the young, to increase muscle tone, to promote the nutrition of the skin, and to assist in tissue respiration. Sherman and Langford[10] make the following statement:

> Shortage of vitamin B_2 stunts growth of the young and at any age causes a lowering of the general tone and a condition of premature ageing or unwholesomeness of the skin with loss of hair. The skin condition has sometimes been called a "non-specific dermatitis" as distinguished from the florid dermatitis of vitamin B_2 deficiency.

[1] Read at a meeting of the Melbourne Paediatric Society on September 13, 1939.

Deficiency of this factor is known to cause cataract in rats[11] and may have a similar action on the human subject. The daily human requirement of vitamin B_2 is stated to be from 400 to 600 Sherman units.

Vitamins B_3, B_4 and B_5 are growth factors detected in animal experiments. Their application to the human subject is not yet determined. Vitamin B_6 is the rat antidermatitic factor. Its absence leads to a florid dermatitis in the rodent, and probably has a similar action on the human body.

The "P.P. factor" (nicotinic acid and its amine nicotinamide) is the pellagra-preventing factor, a well-defined substance, the chemical formula of which is now established. ("Coramine" is diethyl nicotinamide.) The pharmacology of this substance is not yet known, but it is stated to be concerned in carbohydrate metabolism. Several test subjects to whom I administered 50 milligrammes of this product stated that they felt a curious burning sensation in the skin from four to eight hours after taking it.

Recent work in America[12][13] based on animal researches by Elvehjem in Wisconsin have definitely shown that pellagra can be rapidly cured by administration of nicotinic acid in oral doses ranging from 100 to 500 milligrammes or in repeated parenteral doses of 10 to 20 milligrammes. It may sometimes produce toxic effects.

Foods which contain nicotinic acid most abundantly are liver, eggs, milk and cheese.

Lack of the whole vitamin *B* complex should, if the foregoing pharmacology is correct, lead to polyneuritis, mental changes, dermatitis, œdema, lack of growth in the young, muscle hypotonia, anæmia and gastro-intestinal dysfunction.

Vitamin B_1 could be rationally used because of its antineuritic value for any lesion of the nervous system which has developed as the result of inflammation, or is essentially a degeneration in process, whether as a direct result of vitamin B_1 lack or otherwise. Such conditions as diphtheritic, arsenical or alcoholic polyneuritis, disseminated sclerosis, combined lateral degeneration, tabes, acute ascending myelitis (Landry's), sciatica, herpes and poliomyelitis may be grouped in this category.

Vitamin B_2 could similarly be rationally employed for stunted growth, and for dermatitis, whatever the cause.

Nicotinic acid is more likely to be useful, in addition to its use in fully developed pellagra, in the minor grades of the disorder, which incidentally may be more common in the community than we have been led to believe. There is certainly a wide field for its clinical trial in the psychoses,[14] especially the affective states, and in the minor neuroses so commonly seen in our consulting rooms. The resemblance between manic and depressive states and the mental changes of pellagra is too striking to be dismissed lightly.

One important factor in vitamin *B* therapy is that in certain diseases at least, dosage, in order to be effective, must be many times larger than the minimal requirement for healthy subjects.[15] Perhaps a state of relative insufficiency may be produced by an inability of the tissues to absorb or utilize the vitamin. An analogy may be found in the use of iron in secondary anæmia.

The continued use of the vitamin B_1 factor does not appear to be accompanied by toxic symptoms, even when given in doses approximating ten times the daily minimal requirement. The excess is stated to be excreted in the urine. I have used doses of 5,000 units of vitamin B_1 daily without any demonstrable toxic effect. No such certainty is associated with the B_2 factor and nicotinic acid; the latter especially may be toxic in excess, but its use in large doses is too recent for any authoritative pronouncement to have appeared in the literature.

Our experience in the Wimmera, a district of north-western Victoria, has led us to believe that vitamin *B* is lacking in many diets in our locality. A study of the average diet reveals the fact that very little food is eaten raw. White bread is the staple cereal food, and despite the fact that the district is largely a cereal-producing area, wholemeal is rarely incorporated in the family dietary. The grain is sent to the mills, and the relatively vitamin-deficient white flour is used for baking, whilst the bran, rich in vitamin *B*, is fed to the stock and poultry. Moreover, vegetables are being cooked with soda, which is particularly destructive of vitamin B_1, and the water, containing much of the vitamin residue in solution, is poured down the sink. On the farms, vegetables are scarce from January to April, and although the towns are fairly liberally supplied, the farmer has to depend largely on weekly visits to his market town for his vegetable supply, which as a result is often meagre. This conclusion has prompted the rather extensive use of vitamin *B* in treatment, with decrease in symptoms which had previously exhausted our therapeutic equipment.

Pink disease in children is a condition which suggested itself as worthy of treatment along the lines indicated. Up to the present the cause of pink disease is unknown, and its treatment is therefore symptomatic. There are, however, certain features of the disease which show a resemblance to beriberi and pellagra, notably polyneuritis, changes in temperament, digestive disturbances, skin rashes, muscle hypotonia, œdema and vascular disturbances in the extremities. It was this fact which induced me about twelve months ago to treat a patient suffering from pink disease with vitamin *B* in doses larger than those usually prescribed. Since then I have treated three other patients with vitamin *B* preparations. The results obtained in the four cases have been encouraging, and for this reason I venture to present the case histories to you.

Reports of Cases.

CASE I.—K.B., a male baby, aged seventeen months, was first seen in July, 1938. His sister had had pink disease in 1936; consequently his mother was familiar with the symptoms and brought him for treatment early

in his illness. When first seen he was peevish and irritable, and showed the usual misery which one associates with pink disease. He had lost several pounds in weight, and had hypotonia, photophobia, sweating, a sudaminal rash and very pink hands and feet. Peeling of the extremities was not evident at this stage. Insomnia, anorexia and a crouching attitude completed the typical clinical picture of the disease.[3b] Mild bronchitis and coryza were the only apparent complications, and the temperature was not elevated at any stage. The pulse rate varied between 130 and 140 beats per minute. The urine was normal.

The child was admitted to hospital at about the end of the fourth week of his illness, and during the succeeding fortnight his symptoms became intensified in spite of small doses of liver extract by mouth, vitamins *A* and *D* in the form of "Halivol", fruit juices, small doses of heliotherapy and general symptomatic treatment.

During the seventh week of the disease three tablespoons of "Bemax" (600 units of vitamin B_1) were given by mouth each day without variation in the above treatment. Within a period of five days a definite improvement was noticed. The child's appetite improved, he was noticeably less miserable, he slept better, and his hands and feet were losing their "raw beef" appearance. This improvement continued until at the end of a fortnight he had almost recovered, and at the end of three weeks was apparently cured.

The points of interest in this case are, firstly, that it was the second case of pink disease occurring in the same family within two years, suggesting a possible dietetic deficiency; and, secondly, the rapid improvement which followed the oral administration of 600 units of vitamin *B* daily. The improvement may, of course, have been coincidental; but it is unusual to find a natural improvement in this disease and a restoration to health before the tenth week.

CASE II.—E.S., a female, was aged eleven months. The mother stated that the patient had been a healthy baby up to six months, and since then had become thin and miserable, with red, peeling hands and feet. Examination showed that the baby's was a typical case of pink disease. Her hands and feet were of "raw beef" colour and desquamating. She was covered with a sudaminal rash. Hypotonia, wasting, œdema, general misery, insomnia and anorexia were pronounced. The mother stated that the child appeared to be gradually becoming worse. She would not allow the child to be admitted to hospital, and as they lived thirty miles away I saw the baby only at weekly intervals.

The baby had been receiving vitamins *A* and *D*, iron and symptomatic treatment for months. The only change made in her treatment was the oral administration of "Vibex" extract (vitamins B_1 and B_2), ten drops three times a day. This dose was increased after two weeks to twenty drops three times a day (180 units of B_1 and 30 units of B_2). The baby was also given a weekly dose of ultra-violet light (one and a half minutes at forty inches distance). At the end of the first week of vitamin *B* therapy the child's condition was distinctly improved. Her extremities were more normal in colour, her rash was fading and her general misery had diminished. At the end of the second week her extremities were even less red, she was eating well and had commenced to play with her toys. By the third week of treatment her hands and feet appeared normal and her weight had increased from the original weight of fourteen pounds five ounces to fourteen pounds fourteen ounces. By November 25, 1938, four weeks after vitamin *B* treatment was instituted, she was almost normal except for the fact that she was four pounds underweight and had a slight persistence of the sudaminal rash.

I think that this child was underdosed with vitamin *B* owing to an error on my part in assessing the potency of the preparation used. The result in this case lacks conclusiveness, because the disease was at a stage (the sixth month) at which one could expect a natural improvement.

CASE III.—G.W., a male, was aged three years. This child developed pink disease at the age of twenty months and was ill for seven months. He was treated by "Halivol" (vitamins *A* and *D*), weekly doses of ultra-violet light, small doses of liver extract and symptomatic treatment. He appeared to be slightly improved after each dose of ultra-violet light, the improvement lasting only several days after each treatment. Even after apparent recovery from the disease he was not perfectly well, being irritable at times, with bouts of insomnia. His appetite was capricious and his weight below normal.

In April, 1939, when three years old, he appeared to suffer a recrudescence of the original illness in a milder form. He had anorexia, irritability, insomnia and sweating. His hands and feet became pink, but there was no desquamation. His pulse rate increased without any feverishness, and he was losing weight. A careful physical examination failed to reveal any cause for the condition other than a return of his original malady, pink disease.

When first seen during this recrudescence, he had had his symptoms for four weeks and, according to his mother's statement, appeared to be gradually becoming worse. Crystalline vitamin B_1 in the form of "Vibex" tablets was ordered in oral doses of one milligramme per day (333 units), no other medical treatment being employed. His mother took care of him at home. Within a few days his condition had improved, and within a week all his symptoms had disappeared. He was given this dose of "Vibex" for four weeks, after which it was reduced to 0·5 milligramme daily.

When last seen eight weeks after the onset of this relapse he was healthy and happy, and had gained four pounds in weight.

The reappearance of pink disease nine months after an apparent recovery seems to be rare. I have no doubt in my own mind that this child's second illness was a recrudescence of the original disease, as I attended him through both illnesses and the second attack was exactly similar to, but milder than, the original one.

CASE IV.—H.B., a well nourished male child, aged fourteen months, was admitted from a neighbouring town to the Horsham Base Hospital on June 4, 1939. His mother stated that about four weeks previously he had become peevish and difficult. He had gradually developed sleeplessness and refused to play with his toys. Questioning of the mother revealed the fact that he had been breast fed to the age of ten months, and had since then been fed with bits and pieces from the family table. Vegetables and fruit were scarce owing to the severe drought and unusually intense summer heat. White bread and meat were the staple articles of the family dietary.

During the week prior to his admission to hospital a cough and feverishness had developed, and he was admitted with a diagnosis of bronchitis. His temperature was elevated to 101° F. (38·3° C.), his pulse rate was 130 per minute, and his respiration rate 26 per minute. His upper first premolar teeth were just appearing through the gums. His fretfulness and irritability were out of proportion to the severity of his bronchitis, and were at first thought to be due to teething. He frequently assumed a crouching attitude in his cot, and he was intolerant of light. His hands and feet were bright pink in colour, but were not peeling, and there was a miliarial rash on his trunk associated with much sweating. Muscle hypotonia was a prominent sign, the child being unable to pull himself up in his cot, and his limbs could be easily placed in acrobatic positions.

Treatment instituted on his admission to hospital consisted of 0·5 cubic centimetre of "Edwenil" given subcutaneously for two days, *Vinum Ipecacuanhæ* in emetic

doses, a mild stimulant expectorant mixture, four minims of "Halivol" night and morning, and a kaolin plaster to his chest and back. His temperature and pulse and respiration rates subsided to normal after four days of treatment, but his general symptoms became intensified. He was more difficult to pacify and slept very little. By the tenth day after his admission to hospital his hands and feet were peeling freely and were of a bright pink colour.

On the eighth and succeeding days he was given vitamin B_1 tablets, one milligramme (333 units) orally night and morning, in addition to the treatment previously described. His general condition seemed to be stationary for the succeeding four days, when he was discharged from hospital at the request of his parents, who considered that they could manage him at home. Two days were enough to convince them that this was unwise, and he was readmitted to hospital on June 17, 1939, with slight intensification of symptoms.

Treatment with vitamin B_1 tablets in the same dosage was continued during the succeeding week, the seventh week of his illness and the second of vitamin B_1 treatment. A slight improvement in his general condition was noticed during this week. The nursing staff stated that he was sleeping better and that he was more tractable. His photophobia was less noticeable, and his appetite had improved, but his extremities were still red and peeling and the sudaminal rash was still in evidence.

Treatment with "Vibex" was discontinued at the end of this week, as I was anxious to find whether the vitamin B_1 was responsible for the improvement. I am of the opinion that during the succeeding week there was little, if any, improvement, but that some intensification of his symptoms occurred on the fifth day.

Treatment with cereal germ in the form of "Bemax" was commenced at the beginning of the ninth week, the dose being a heaped tablespoonful three times a day. The child took this without difficulty with milk and a little sugar. His other treatment at this time consisted of four minims of "Halivol" twice a day and the same mild expectorant mixture.

I noticed a distinct improvement in the child in a few days. He slept much better, his appetite improved, his extremities became more normal in appearance, he began to take an interest in his surroundings, and his sweating and skin rash were reduced. A fortnight after wheat germ therapy was instituted he was a happy little chap, sleeping and eating normally. His hands and feet had resumed a normal appearance, and his limbs were rapidly regaining strength. He was well enough to be discharged from hospital at this time, and his subsequent convalescence was uneventful. "Bemax" therapy was continued by his mother, and two weeks after his discharge from hospital he appeared to be quite well, notwithstanding the fact that he was cutting his lower premolar teeth.

This child was a classical example of pink disease. It is interesting to note that although his response to "Vibex" tablets was not very convincing, yet his improvement after the use of wheat germ was remarkable. According to the manufacturers' claim, both these substances contain the same amount of vitamin B_1 in the doses given—that is, about 600 units a day; but "Bemax" is stated to contain in addition the various other factors of the vitamin *B* complex.

Discussion.

In the reviewing of these cases, the work of Durand, Spickard and Burgess, of Seattle, may help to throw some light on the subject. In January, 1939,[17] they described the treatment of two patients with pink disease (acrodynia) by subcutaneous injection of vitamin B_1 in doses of 2,000 units a day. The results are moderately convincing, distinct improvement occurring a few days after treatment was instituted, but apparently ceasing when oral doses of 600 units were substituted for the injections. In the four cases that I have presented to you improvement seemed to occur after the oral use of 180 to 600 units of vitamin B_1 a day; but in three of them the therapeutic agent used also contained appreciable quantities of the other factors of the vitamin *B* complex. The disorder of the other patient treated by vitamin B_1 alone was of the nature of a mild recurrence with predominating polyneuritic element; on general principles one would expect this to be improved by vitamin B_1 therapy.

It is possible that pink disease is really a deficiency disease and that the substance or substances lacking may be part or the whole of the vitamin *B* complex. At first sight the cases I have presented would seem to support that contention. On the other hand, it may be due to a virus infection with the brunt of the infection falling on the peripheral nervous system. Lack of vitamin *B* may be one of the factors which render the peripheral nervous system more prone to attack by the virus. In any case, treatment by vitamin B_1 could be expected to reduce the symptoms by virtue of its action in reducing polyneuritis. In short, I do not think that the series I have presented either proves or disproves the deficiency or the virus theory of the causation of the disease, although I must confess that my own bias is toward the former; and for this reason I am of the opinion that the various factors of the vitamin *B* complex, including nicotinic acid, are deserving of further clinical trial in the condition. The similarity of pellagra and pink disease gives theoretical reasons at least for this line of therapy.

Conclusion.

One cannot attempt to draw any definite conclusions from so small a series as four cases, but they are presented in the hope of securing your help and of invoking your criticism. Perhaps you may feel disposed to put this form of treatment to the test in your own practices. Maybe you will find it ineffective; but if I have stimulated your interest this paper will not have been in vain.

Acknowledgement.

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References.

(1) J. H. Spencer: "The British Encyclopædia of Medical Practice", Volume IX, page 470.
(2) E. F. Gilder: "", *The New England Journal of Medicine*, Volume CCII, 1930, page 523.
(3) M. B. Strauss: "Nerve Disorders Arising from Defective Nutrition", *The New England Journal of Medicine*, Volume CCXV, December 17, 1936, page 1164.
(4) C. L. Hartsock: "Rôle of Deficiency Disease in Diseases of the Gastrointestinal Tract", *Review of Gastroenterology*, Volume III, June, 1936, page 111.

(9) R. A. Peters and R. H. S. Thompson: "Pyruvic Acid as Intermediary Metabolite in Brain Tissue of Avitaminous and Normal Pigeons", *The Biochemical Journal*, Volume XXVIII, 1934, page 916.
(10) J. M. Vaughan and D. Hunter: "Treatment by Marmite of Megalocytic Hyperchromic Anæmia occurring in Idiopathic Steatorrhœa", *The Lancet*, Volume I, April 16, 1932, page 829.
(11) B. Minz: "*Le rôle de la vitamin B_1 dans la régulation humorale du système nerveux; propos thérapeutiques*", *La Presse médicale*, Volume XLVI, September 21, 1938, page 1406.
(12) M. G. Vorhaus, R. R. Williams and R. E. Waterman: "Studies in Crystalline Vitamin B_1", *The Journal of the American Medical Association*, Volume CV, November 16, 1935, page 1580.
(13) G. R. Cowgill: "The Vitamin B Requirements of Man", 1934.
(14) H. C. Sherman and C. S. Langford: "Riboflavin: Dietary, Sources and Requirements", *The Journal of the American Medical Association*, Volume CX, April 16, 1938, page 1278.
(15) E. M. Nelson: "The Components of the Vitamin B Complex", *The Journal of the American Medical Association*, Volume CX, February 26, 1938, page 645.
(16) W. H. Sebrell: "Vitamins in Relation to the Prevention and Treatment of Pellagra", *The Journal of the American Medical Association*, Volume CX, May 14, 1938, page 1665.
(17) T. D. Spies: "Response of Pellagrins to Nicotinic Acid", *The Lancet*, Volume I, January 29, 1938, page 252.
(18) H. M. Cleckley, V. P. Sydenstricker and L. E. Geeslin: "Nicotinic Acid in the Treatment of Atypical Psychotic States", *The Journal of the American Medical Association*, Volume CXII, May 27, 1939, page 2107.
(19) M. G. Vorhaus *et alii*: *Loco citato*.
(20) C. Rocaz: "Pink Disease" (translated by I. J. Wood).
(21) J. I. Durand, V. W. Spickard and E. Burgess: "Acrodynia Treated with Intramuscular Injections of Vitamin B_1", *Journal of Pediatrics*, Volume XIV, January, 1939, page 74.

TRAUMATIC BACKACHE.

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TRAUMATIC BACKACHE is a constant source of worry to the medical practitioner. I think this is due in a large measure to the inability of the examiner to find any external signs in the great majority of cases; for example, when the knee has been the seat of injury we have perhaps a synovial effusion and almost certainly a wasting of the quadriceps muscle, while any limitation of movement is readily appreciated. Then we have the neurotic whose symptoms may not be genuine or, to say the least, are exaggerated. I hope in this paper to give some help with these difficulties, and it is my intention to deal more especially with the commoner type of case, omitting such lesions as fractures of the vertebræ *et cetera*.

The Nature of the Injury.

It is very useful to know the nature of the injury in these cases, as it helps us to decide where the bulk of the damage may have occurred. Any force acting from above is more likely to injure the lumbo-sacral region, while one acting from below tends to injure the sacro-iliac area; this is not the invariable rule, but is of help in the final summing up. It is quite possible that a muscle injury may be sustained when the whole weight of something being carried is suddenly thrown onto the patient as his mate unexpectedly drops his end of the article. An excessive lift with the hands above the head is conducive to a strain in the upper dorsal region. With the history of a rotation strain a fracture of a lamina or a pedicle will be suspected. A fall on the buttocks will make the examiner think of an injury to the intervertebral disks, or if the fall has been from a height and there has been a "jack-knifing" of the trunk, a crush fracture of a vertebral body is very likely to be present. The greatest number of patients, however, will relate that they were lifting something when they felt a sharp pain in the lower part of the back.

Symptoms.

As mentioned above, the injury may be anything from a fall from a height to a simple twist of the body; pain is of immediate onset and is very acute, described by most patients as "a knife being stuck in the back". If the patient is stooping at the time of the onset of the pain he straightens himself cautiously and places a hand firmly on the affected part for added support; once he has assumed the upright position he takes on a posture that gives him most comfort and this is maintained involuntarily. The posture is generally one of slight flexion of the lumbar part of the spine with a certain amount of rotation and lateral flexion. The gait is best described as guarded, and all movements are carried out with the greatest care. As long as the posture is maintained there is very little pain, but any unguarded movement is accompanied by the sharp pain again. If the patient is not seen for two or three days after the injury he will invariably remark that he has great difficulty in getting out of bed in the morning because of the pain, but his comfort increases after he moves about for a while. If the patient has sustained one of the more severe lesions, such as a fracture, the symptoms at the time of the accident will be more marked and he will exhibit some signs of collapse; it is not, however, with such cases that we are concerned in this paper.

The symptoms of the patient who is seen for the first time weeks or even months after the injury will not be so acute, and the localization of the pain may be vague and represented by the patient's placing of his hand across the lower lumbar area; on the other hand, it may be localized to a very definite site, such as the upper sacro-iliac region, the lumbo-sacral area or the middle lumbar region on either side. The main characteristic of the pain at this stage is that it is eased after exertion and moving about, although it frequently recurs after prolonged action; the patient often volunteers the information that sitting or standing in one position for any length of time aggravates the pain. The feature that distinguishes the pain from that caused by some lesion of the viscera is the ease that is obtained by some posture or other. Besides the pain in the back, there may be pain referred down the thigh and leg; I used to believe that the site of this latter pain helped in the localization of these so-called chronic strains, but now I do not think the site is of any significance. With lesions of the dorsal region of the spine pain may be referred to different levels of the trunk and resemble that of some visceral condition; on being questioned about the pain the patient will remark that there is a sensation of something tight at the

site of the pain, besides which there is always a certain amount of tenderness in the back itself. It is because of these referred pains that many patients have been cured of their "indigestion" by means of a spinal manipulation. In some of these late cases pain is felt only on certain movements, while they may aggravate it in others.

Physical Examination.

Type of Patient.—The type of patient is of great importance, especially in regard to the prognosis. Some patients cannot be made to cooperate in any circumstances, and give the impression that they do not want to get well.

Posture and Gait.—The main thing to keep in mind under the heading of posture and gait is the exaggeration of the neurotic and the malingerer; the essential points of posture and gait have been mentioned under "symptoms". It is, however, important to see whether there is any postural fault in the feet or any deformity of the lower limbs, such as shortening of one leg, knock-knee *et cetera*. Recognition of these faults is frequently omitted and they may have an important bearing on the subsequent history of the case.

Scoliotic Pattern.—The scoliotic pattern has been completely ignored in the past and its importance has been emphasized recently by Pitkin, of America. In the absence of a complete scoliotic pattern it is perfectly justifiable to consider that there is no true organic lesion present in the spine or its adnexa. What is a complete scoliotic pattern and how is it recognized? A complete scoliotic pattern is one in which there is a list of the body to one side, a lumbar curve, a rotation of the shoulder girdle and a rotation of the pelvic girdle. This pattern can be recognized only by the use of a plumb-bob and a straight-edge; the former is held in such a way as to determine the vertical line running upwards from the natal cleft, and a list of the body is present when the *vertebra prominens* is to either side of this vertical line. The lumbar curve is determined by marking of the tips of the spinous processes with ink, while rotation of the shoulder girdle is seen by the placing of a straight-edge across the back at the level of the middle of the scapulæ and determining which shoulder is more posterior, the line joining the backs of the heels being taken as the base. The same method is applied to the posterior superior iliac spines to find which side of the pelvis is rotated backwards. I am convinced the pattern is never complete in the absence of an organic lesion; the list of the body, the lumbar curve, the rotation of the shoulder girdle or the rotation of the pelvic girdle will be absent if the back is normal or sufficiently recovered to be used normally. The change in the pattern can be demonstrated dramatically at times after a spinal manipulation without an anæsthetic. There are numerous combinations of these four components of a complete scoliotic pattern, but I cannot convince myself that some mean one thing and others another. There is one other important factor about these patterns—they do not change until some improvement takes place in the condition responsible for them. There is, however, one exception, and that is in those rare cases in which an alternating scoliosis is present. If you ask a patient to walk about the room and at the same time to carry out some simple action involving the use of the back and the pattern changes, you can be reasonably certain that the symptoms are not due to any intrinsic lesion or that the pattern was not complete. I attach a great deal of importance to this part of the examination of a back, and the habit of recording the pattern in every case is very easily and very readily acquired.

Tenderness.—The common sites of tenderness are over the *erector spinæ* masses in the lumbar region, the lumbo-sacral areas and the sacro-iliac regions. It is reasonable to assume that these sites refer to the area injured, although in the first one mentioned this sign does not help us to differentiate between aponeurosis, muscle, joint or bone, while in the other two the joints are nearer the surface. The tenderness over the lateral lumbo-sacral areas may be due to a tearing of the fibres of origin of the sacro-spinalis muscle from the iliac crest. This symptom, however, is only one link in the chain, and taken by itself cannot be of very great significance. It is a common experience to see patients with tenderness over the sacro-iliac area or the upper border of the greater sciatic notch, and the rest of the examination will disclose a lumbar spondylitis. In these cases I am inclined to think that we are dealing with referred tenderness, and I do not place a great amount of reliance on the site of tenderness as a localizing factor in the final diagnosis.

Movements.—The estimation of the range of active and passive movements of the spine is most helpful, but before going any further I should like to point out that it is possible for a patient with a perfectly rigid spine and extended knees to touch the toes provided the hip joints are healthy. The bulk of spinal flexion, and this includes lateral flexion, takes place in the lumbar spine, while rotation occurs mainly in the dorsal region. In cases of so-called traumatic lumbago it is generally found that one or more of the movements is full; if all the movements in any particular area are limited, it means arthritis is present as well as the added factor of trauma. Naturally a spine affected with arthritis is more liable to injury than a normal spine.

It is at times possible to differentiate muscle lesions in traumatic backache. If there has been an injury to any part of the muscle masses of the back there will be pain on passive stretching of the muscle, as on forcing the trunk further forward than the patient will bend actively, and on the patient's contracting the muscle against resistance, such as rising from a stooped position against the force of the examiner's hand. If this test is carried out properly it will be found that tears of the muscles are very rare indeed.

Head Flexion Test.—The head flexion test is carried out, with the patient lying supine on the couch, by the examiner's placing one of his hands behind the patient's occiput and lifting the head forwards so as to make the chin approximate the upper end of the sternum. It is essential that the patient should relax completely and let the examiner's hand make the necessary movement. If there has been a bony injury anywhere in the spinal column above the level of the sacrum the patient will complain of pain at the site of the lesion as the head is flexed. On more than one occasion I have with this simple test diagnosed a double lesion, which has been verified subsequently by X ray examination. I consider that this test should be carried out on every patient with a history of injury to the back, especially before any attempt at spinal manipulation is made, and, if there is any doubt, an X ray examination should be made immediately. I have already mentioned the importance of a torsional injury of the trunk and its association with fractures of the pedicles and the laminæ; with these injuries, as well as with fractures of the transverse processes, the result of the head flexion test is invariably positive. If this test gives a positive and the X ray examination for an osseous lesion a negative result, it is advisable to repeat the test in four days' time and, if the result is still positive, to refer the patient back to the radiographer with a request that he should take pictures of the particular area of the spine in several oblique positions to rule out a fracture of the pedicles and laminæ.

Knee Flexion Test.—The main importance of the knee flexion test is to determine the genuineness of the symptoms. It is carried out with the patient in the prone position by his flexing the leg on the thigh. If there is a lesion in the lower part of the back pain will be produced with the leg at varying angles to the thigh, according to the severity of the lesion. A complaint of pain or a feeling of tightness in the front of the thigh is of no consequence, and the absence of pain in the back should make the examiner very careful of diagnosing any intrinsic back lesion. A negative response to the knee flexion test and an incomplete scoliotic pattern should be sufficient for the examiner to tell the patient that no other treatment than a return to work is necessary. If I should see a patient who gave a positive reaction to the knee flexion test but who had an incomplete scoliotic pattern (so far I have not seen such a patient) I think I should put my faith in the former test.

Straight Leg Raising Test.—The straight leg raising test is carried out with the patient lying supine by his flexing the straight leg at the hip joint; it is merely an adjunct to the former test and is never as reliable.

Gaenselen's Test.—Designed to put strain on the sacro-iliac joints, Gaenselen's test is carried out with the patient lying supine at the edge of the couch and with the leg of the painful and tender side hanging over the edge. Steadying the dependent leg with one hand, the examiner flexes the opposite hip and knee joints as far as possible; this throws on the pelvis a strain which must be transmitted through the sacro-iliac joints, and if either of them is involved pain is felt in the affected joint as the flexed thigh is forced onto the abdomen. It is as well to carry out the test on both sides.

Nervous Signs.—No examination of the back is complete until the knee jerks, ankle jerks and plantar reflexes have been tested. In all doubtful cases disturbances of sensation must be looked for. Naturally, if there are any nervous signs, their cause must be discovered.

X Ray Examination.—A complete series of X ray photographs must be taken in all doubtful cases, but I do not think they are necessary in the great majority. If all the above signs were absent it would be an unnecessary expense to have films taken on the off chance of discovering the cause of the pain; if there is any doubt, however, an X ray examination will naturally be made. It is as well to remember that the patient with a secondary malignant deposit in a vertebra frequently has only one sign present, and that is a small localized gibbus; there may be a full range of movement at the involved area, and it is only this small localized gibbus that will give any indication of the underlying pathology.

Diagnosis.

Before the final diagnosis of traumatic backache is reached, such serious lesions as tuberculosis of the spine, fractures, malignant disease *et cetera* must be excluded. It is a very natural thing to blame trauma for any pain or ache we get in the back, and the fact that compensation may be claimed if the trauma has been sustained at work tends automatically to link one's occupation with the pain. Because of this tendency it is most important to examine the back thoroughly and systematically before any line of treatment is decided upon.

I am not going to describe the pathology of traumatic backache beyond stating that I believe the lesion in most of these cases is either a subluxation of one of the intervertebral joints or an incomplete tear of an adhesion in the periarticular tissues.

Treatment.

In Cases with no Evidence of Spondylitis.—Most patients who have no evidence of spondylitis can be treated by the method of spinal manipulation without anæsthesia as soon as possible after the injury. The actual technique used will be described at the end of the article. Some patients will receive such a great deal of benefit that they will elect to return to work immediately and come to the rooms for daily manipulations for several days. They are all instructed to do spinal exercises in the Swedish manner every night and every morning until they are no longer conscious of any disability in the back. It is exceptional to have to declare any worker unfit for more than a week; the average disability period of one series of two hundred

persons has been between four and five days. In this particular series the insurance company concerned pays for the treatment, even if the worker does not go off work, and makes up the wages in a lot of cases in which the disability period is less than a week. I think this latter fact has helped considerably, but before this method of treatment was instituted the average disability period was a little over five weeks.

If there has been a muscle injury in the nature of a tear of some of the fibres I find it essential to give some support and order rest for a few days; about the fourth day I give a spinal manipulation, continuing the course until the symptoms have disappeared. The only support I give is the affixing of adhesive strapping in the appropriate direction. In my experience these cases form a very small minority of the patients with traumatic backache.

In Cases with Evidence of Spondylitis.—Most people over the age of thirty-five will have varying degrees of spondylitis, and its presence can be detected clinically in every case. Some of these people will stand an immediate spinal manipulation after an injury, but if the arthritic changes are at all pronounced a few days' rest will be needed first and then they can be treated as if the spondylitis did not exist. If the limitation of spinal movements—it is nearly always the lumbar region that is involved—is not very marked, I attempt a manipulation at the first visit and base my future management of the case on the reaction to it. On the other hand, if there is marked limitation of movements of the spine I order an X ray examination to determine the exact state of the bony changes; and if they are as advanced as I expect I order a week's rest in bed and then start my manipulations; if at the end of four days there is no improvement I recommend the application of a light plaster cast.

In all these cases of spondylitis it is advisable to pay particular attention to the feet for evidence of postural defects and to treat them if they exist.

Technique of Spinal Manipulation without Anæsthesia.

A. With the Patient Lying Prone.

1. With the patient lying prone on the couch, his arms by his side and his head turned to one side, the surgeon's hands are placed on the back at the upper end of the dorsal area so that the hands are each side of the line of the spinous processes. Before taking up this position it is essential for the operator to see that his shoulders are at least forty inches above the level of the couch when he is standing upright; this is necessary for the amount of force and purchase needed in this and the subsequent manipulations. With the hands in the required position the operator makes a sudden thrust downwards, using the bulk of his weight in the manœuvre; the hands are then brought down the spine a few inches and the manœuvre is repeated; this is continued all the way down the spine to the sacrum. This manipulation always causes a certain amount of discomfort when the hands are over the dorso-lumbar junction, and it is wise not to be too vigorous at this site.

2. After completing the above, repeat the process, but with one hand only on the back and placed so that the heel of the hand lies over the spinous processes; the operator superimposes his other hand and makes firm pressure directly downwards onto the back. He begins at the top of the spine and works down to the sacrum.

3. Raise one of the patient's legs from the couch with one hand and, with the other hand placed over the upper sacro-iliac area of the same side acting as a fulcrum, sharply and forcibly hyperextend the raised thigh.

4. Repeat the procedure with the opposite limb.

5. Raise both the patient's legs from the couch with one hand and, placing the other over the lumbo-sacral area, forcibly hyperextend the thighs and press downwards with the hand over the lumbo-sacral area.

6. Repeat the above manipulation, but place the fulcrum hand over the upper lumbar area and hyperextend the lumbar region.

B. With the Patient Lying on the Right Side and with the Left Knee and Thigh Slightly Flexed so as to allow the Limb to Fall Forward onto the Couch, and with the Left Arm Placed on the Couch Behind the Body.

7. Place the right hand or forearm on the patient's buttock and the left hand on his left shoulder, then pull the left side of the pelvis forwards and at the same time thrust the left shoulder sharply backwards. This manœuvre imparts a rotation strain on the spine and is invariably accompanied by a few snapping sounds.

8. Repeat the manipulation with the patient lying on the left side.

C. With the Patient Lying Supine.

9. Place one forearm under the patient's knees, flex the thighs onto the abdomen and draw the knees back towards the shoulders; at the same time force the thighs onto the abdomen and thorax.

10. Make the patient sit up and force the upper part of the trunk forwards towards the extended legs.

11. Raise the right leg off the couch until it is at right angles with the trunk; if the knee should flex, straighten it several times so as to stretch the hamstring muscles.

12. Repeat the manipulation with the left leg.

13. With the right arm across the patient's waist grasp the far side of the couch, steady the patient's right shoulder with the left hand and have an assistant pull the patient's legs to the left side off the couch so as to obtain lateral flexion of the lumbar spine. If the operator is without assistance this manipulation can be carried out with the patient lying on his side on the floor; the operator then lifts him with his hands placed under the lower loin. This latter method can be very difficult if the patient is heavy.

14. Repeat the procedure on the opposite side.

Reports of Cases.

REPEATED HÆMATEMESES ASSOCIATED WITH BANTI'S DISEASE OF "CONCEALED" TYPE.

By J. D. HERLIHY,
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A PATIENT suffering from hæmatemesis can, at times, provide quite a knotty diagnostic problem. The profuse hæmorrhage so often found as an early symptom of cirrhosis of the liver has been in the past extremely difficult to diagnose from that produced by gastric ulcer. The hepatic cause may even remain in doubt until years later, when ascites and cholæmia supervene.

The difficulty of an early "final diagnosis" increases, however, when bleeding occurs without premonitory symptoms in apparently healthy individuals.

In the case detailed below a careful history failed to elicit any constant gastro-intestinal upset, nor did direct questioning help. There was, however, a history of (i) slight nausea at times, and (ii) an attack of "gastric influenza" (*sic*), associated with one vomit of a little blood about three months before, and this provided us with a slender clue. The full blood count (which, unfortunately, was made only after the first transfusion) was not directly helpful, except that, apart from a secondary type of anæmia, it was noted that despite the fairly large drip transfusion the total number of blood platelets was greatly diminished. Now in normal persons hæmorrhage usually increases the platelet count, whilst infused platelets have a life of about three to five days when rapid destruction is not taking place. Thus a second suspicion arose.

Again, it was extremely difficult, after examination of the patient, to reconcile the extremely good general condition of the patient, who had just had four fairly large hæmatemeses, with the usual classical signs of similar happenings with bleeding from peptic ulcers.

We felt confident, in view of these findings, taken in conjunction with the history, that we were confronted, not with peptic ulceration, but a blood disorder, possibly associated with cirrhosis.

Examination of the abdomen revealed nothing instructive. Pain and tenderness were absent; there was no muscular guarding; some slight distension was present; the liver and splenic dulness was apparently within normal limits; there was no evidence of jaundice or ascites. There were no petechial or purpuric spots, even at the site of the sphygmomanometer cuff. There was a definite denial of alcoholism, and no fever. What, then, was the most likely fundamental morbid process?

Well-known common causes of hæmatemesis may be set out briefly as follows: (i) local gastric conditions, for example, ulcer, cancer, gastrostaxis *et cetera*, duodenal ulcer; (ii) portal congestion, for example, cirrhosis of the liver, splenic anæmia, rarely heart disease and thrombosis of the portal vein; (iii) blood swallowed from the nose, throat, lungs *et cetera*; (iv) trauma; (v) corrosive poisons; (vi) toxic conditions, such as malignant specific fevers, acute yellow atrophy *et cetera*; (vii) blood diseases, such as splenic anæmia, occasionally leuchæmia, purpura, scurvy *et cetera*, rarely hæmophilia; (viii) ruptured aneurysm. The most common causes are ulcer, cancer, cirrhosis and splenic anæmia, particularly when the hæmorrhage is severe.

The position therefore appeared to us to resolve itself into a differentiation between the blood diseases and the portal congestion type of hæmatemesis; or, as seemed probable, it was a disease combining the characters of both these types. There were no indications to suggest purpura, scurvy, Hodgkin's disease, leuchæmia. However, hæmatemesis in the early stages of splenic anæmia or Banti's disease is very common, even before splenic and hepatic enlargement are clinically evident. The patient's age, together with the blood count and history, could quite easily fit in with such a diagnosis.

A short review of this rather rare condition may be to the point.

The symptom complex known as splenic anæmia, which in its final advanced cirrhotic stage is known as Banti's disease, is a chronic progressive disease of unknown origin, characterized by (*a*) splenomegaly, which is not always evident clinically, in the early stages, (*b*) a secondary anæmia with leucopenia and a tendency to gastro-intestinal hæmorrhage particularly, and (*c*) increased hæmolysis of the blood cells. In the later stages there are cirrhotic changes in the liver, with ascites and jaundice.

Whether the condition is a primary splenic disease has not yet been definitely proved. When a constant progressive change is occurring the pathological picture cannot be truly specific; but there is disturbance in the blood "factory" as well as the excessive hæmolysis.

The patient is usually a young adult who is otherwise healthy, and either male or female persons may be affected.

There are three empirical stages: (i) anæmic, (ii) intermediary, and (iii) cirrhotic. This last stage of the disease, if untreated, eventually ends fatally.

In the anæmic stage there is moderate anæmia, usually secondary in type, with few, if any, signs of active blood formation, and there is only a slight increase of reticulocytes. In Osler's series the hæmoglobin value averaged 47%, the red blood cells 3,425,000 and the leucocytes 3,850 per cubic millimetre, the leucopenia being chiefly neutropenia. Hæmorrhage is a constant symptom and most commonly occurs in the upper part of the gastro-intestinal tract, usually from dilated gastric veins or œsophageal varices; it varies in amount from a slight ooze to a large fatal hæmatemesis.

The intermediary stage cannot be distinguished clinically.

In the stage of cirrhosis the anæmia becomes more intense, and ascites with perhaps a mild jaundice appears.

With regard to platelets in Banti's disease, Rosenthal divides these cases into (i) thrombocythæmic and (ii) thrombopenic. He considers the first group particularly liable to thrombosis and the latter group to extensive hæmorrhage.

On the therapeutic side the case was interesting. Our chief concern was whether exploratory laparotomy was justified, in view of the repeated hæmorrhages, or whether we should give transfusions and perhaps tide the patient over this crisis in a blood dyscrasia until such time as the bleeding ceased or more definite evidence was found. We were guided in our decision to continue the slow drip transfusion by the fact that the patient was a young robust woman who three months before had had a hæmatemesis which had ceased without special treatment, that she was responding well to immediate feeding with a modified Meulengracht diet, and also that repeated transfusion was definitely allowing her to hold her own. Then again, in obscure anæmias the benefit of transfusion is often evident only after the third one has been given.

However, after much transfused blood had been used the patient's urine contained blood, the hæmatemesis continued and a definite guarding of the upper half of the left rectus muscle became evident. In view of these findings, Dr. Richard Flynn was asked to see the patient with a view to surgical interference, with a tentative diagnosis of splenic anæmia.

Under nitrous oxide and oxygen anæsthesia laparotomy was performed and a moderate enlargement of the spleen (weight 420 grammes) with definite perisplenitis was found; the left lobe of the liver showed evidence of early cirrhosis, while in the stomach and duodenum no gastric lesion was evident; but there was much blood in the large bowel. Slight ascites was present. Splenectomy was performed and the patient was given a further blood transfusion, together with alkalis, to combat, if possible, further trouble from hæmoglobinuria and eventual anuria.

It may be of interest here to mention that in 1925 Baker and Dodds suggested that the hæmolysed blood was

excreted by the kidneys, in which the hæmoglobin is precipitated by the acid urine as acid hæmatin, the tubules thus being obstructed and uræmia caused, and that death might therefore be prevented by the administration of alkalis.

As the patient had thrombopenia we felt that she had now a more than reasonable chance of a good recovery and that the hæmatemesis would be checked at least.

Clinical History.

Mrs. R.H., aged thirty years, was admitted to hospital at 5 p.m. on May 23, 1939, with a history of having had three attacks of hæmatemesis. She had been comparatively well until that morning, when the first hæmatemesis occurred; the second occurred in the afternoon, the third in the ambulance, and a fourth just after her admission to hospital. There was no definite history of gastric disturbance, other than occasional slight nausea after meals and slight epigastric tenderness. Even direct questions were answered in the negative. She stated, however, that three months earlier she had vomited a very small amount of blood during an attack of "gastric 'flu". Her appetite was good, her weight was stationary and her bowels were well open.

The patient had suffered from measles and parotitis when a child, and had undergone appendicectomy seventeen years earlier. She had had salpingitis eight years earlier, and stated that she suffered still from periodic discomfort, mainly on the left side. Six months earlier she had had diarrhœa for one week.

On examination the patient seemed somewhat pale, but her general condition, if the four hæmorrhages are taken into consideration, was extremely good. There was very slight tenderness in the epigastric region and also in the lower part of the abdomen. The bright blood vomited just after her admission to hospital measured two-thirds of a pint. There was no evidence of alteration in liver dulness and the spleen was not palpable. The pulse was full and the rate was 112 per minute. The systolic blood pressure was 112 and the diastolic pressure 65 millimetres of mercury. No abnormality was detected in the respiratory, cardio-vascular, central nervous and urinary systems.

One hour after her admission to hospital the patient vomited ten ounces of bright blood. A beginning was made with Witt's modified Meulengracht diet. A blood examination gave the following information: the hæmoglobin value was 61%, the colour index was 0·98, the erythrocytes numbered 3,190,000 per cubic millimetre and the blood urea content was 32 milligrammes per 100 cubic centimetres.

On May 24, 1939, there was no further hæmorrhage, but the patient complained of nausea. On May 25, 1939, she vomited ten ounces of blood at 6.30 a.m., three ounces of bright blood at 7 a.m. and ten ounces of bright blood at 8 a.m. The administration of a drip transfusion was begun at 3.30 p.m., and an intramuscular injection of ten cubic centimetres of "Clauden" was given. The vomitus gave a neutral reaction to litmus paper; no food was present.

On May 26, 1939, the drip transfusion was completed at 2.30 a.m.; it had consisted of 1,200 cubic centimetres of blood and 300 cubic centimetres of citrate solution. The administration of saline solution by the drip method was then commenced and was completed at 2.30 p.m., 1,500 cubic centimetres having been given. The systolic blood pressure was then 120 and the diastolic pressure 70 millimetres of mercury. At 6 p.m. the patient vomited 30 ounces of bright blood; at 7 p.m. a further drip transfusion of 800 cubic centimetres of blood with 300 cubic centimetres of citrate solution was started. At 8 p.m. the patient vomited 10 ounces of blood, and at 8.30 p.m., 20 ounces. A further intramuscular injection of "Clauden" was given.

A blood examination was made. The erythrocytes numbered 2,120,000 and the leucocytes 6,250 per cubic millimetre. The hæmoglobin value was 41% and the colour index 0·98. The platelets numbered 150,000 per cubic millimetre. The bleeding time was two and a half minutes and the coagulation time three and a half minutes. The patient was still holding her own and continued to retain liquid food by mouth.

On May 27, 1939, the drip transfusion of blood was continued. At 3 p.m. the patient vomited 20 ounces of blood, and at 5.30 p.m. she vomited 30 ounces of bright blood. On that morning the platelet count was 110,000 per cubic millimetre and the hæmoglobin value was 48%. An intramuscular injection of 10 cubic centimetres of a 10% solution of calcium gluconate was given. A magnesium sulphate and glycerin enema produced a large melena stool. The total amount of blood given to the patient by transfusion on this day was 3,050 cubic centimetres with 870 cubic centimetres of citrate solution. The vomitus still gave a neutral reaction to litmus. Gastric lavage produced a clear return. The urine became blood stained in the later afternoon; its reaction to litmus was neutral. The patient's general condition was still very good and she was retaining food.

On May 28, 1939, the patient vomited 36 ounces of bright blood at 3.30 a.m. The drip transfusion of blood was continued until 11.30 a.m., when the patient had received 1,200 cubic centimetres of blood and 300 cubic centimetres of citrate solution. Hæmaturia was present, and the upper half of the left rectus muscle was on guard.

Under nitrous oxide and oxygen anæsthesia the premedication being one-sixth of a grain of morphine and one one-hundred-and-fiftieth of a grain of atropine, laparotomy was performed. There was no sign of an ulcer in the stomach or duodenum. Blood was present in the large bowel. There was some cirrhosis of the left lobe of the liver; the spleen was moderately enlarged. Splenectomy was performed and considerable perisplenitis and some ascitic fluid were found. A further transfusion of 600 cubic centimetres of blood with 150 cubic centimetres of citrate solution, followed by the administration of 250 cubic centimetres of citrate, was given in the operating theatre. This made a grand total of 6,850 cubic centimetres of blood and 2,170 cubic centimetres of citrate solution. The total amount of blood vomited had been nine pints and seven fluid ounces. The approximate time taken for the transfusion was 69 hours. The patient was taken back to bed in very good condition.

On May 29 there was no further hæmorrhage or vomiting. The erythrocytes numbered 3,210,000 and the platelets 160,000 per cubic millimetre; the hæmoglobin value was 51% and the colour index 0·79; the hæmaturia was gone. The urine was kept alkaline. The patient was retaining fluids given by mouth. She was given one grain of thyreoid extract and vitamins *B* and *C*. "Carbogen" was administered every four hours. On May 30 an enema produced a melena stool. The patient's progress was maintained. The platelets numbered 150,000 per cubic millimetre and the hæmoglobin value was 47%. There was no further vomiting. The administration of "Carbogen" was continued. On June 1 the patient's condition was still improving. The platelets numbered 220,000 per cubic millimetre and the hæmoglobin value was 32%. Iron medication was begun. Melena was present. On June 2 the erythrocytes numbered 2,140,000 per cubic millimetre, the hæmoglobin value was 32% and the colour index was 0·74; the leucocytes numbered 28,700 per cubic millimetre, 80% being neutrophile cells, 4% monocytes and 16% lymphocytes (there were no eosinophile cells). The patient's temperature was elevated and her pulse was rapid. A cough with sputum was present, and she had pain at the tip of her left shoulder. Mild inflammation was beginning at the site of transfusion in the right leg. Dulness was present at the base of the left lung and the breath sounds were diminished. It was thought that fluid might be present and that pneumonitis might be developing. The next day the patient's condition was much the same. On June 4 the erythrocytes numbered 2,110,000 per cubic millimetre, the hæmoglobin value was 35% and the colour index was 0·86; 3·8% of the erythrocytes were reticulocytes, and the platelets numbered 215,000 per cubic millimetre.

On June 6 the administration of "M & B 693" tablets was begun. The patient was slightly jaundiced and the

signs in the chest had not altered. Five cubic centimetres of "Campolon" were given and no further bleeding occurred. Dr. Shearman's report on the spleen was as follows:

> Microscopic section shows congestion with a tendency to fibrosis, but the normal architecture of spleen is still for the most part maintained.

On June 7 the patient vomited undigested food and bile. The gauze was removed from the wound and her pain was relieved. On that day the erythrocytes numbered 1,710,000 and the platelets 210,000 per cubic millimetre; the hæmoglobin value was 30% and the colour index 0·79. The patient was still jaundiced and appeared weak and dyspnœic. On June 8 she was still vomiting slightly; two cubic centimetres of "Campolon" were given night and morning. The erythrocytes numbered 2,310,000 and the leucocytes 23,850 per cubic millimetre; the hæmoglobin value was 35%.

On June 10 the patient's cyanosis and dyspnœa were somewhat relieved by oxygen. The erythrocytes numbered 2,380,000 and the platelets 220,000 per cubic millimetre; the hæmoglobin value was 41% and the colour index 0·85. The sutures were removed. On June 12 the administration of "M & B 693" was suspended. The patient was given oxygen continuously, as she had pronounced dyspnœa. Pus was draining from the wound and slight jaundice was still present. On June 13 the dyspnœa was more pronounced, the pulse was rapid and the temperature was elevated. The erythrocytes numbered 2,790,000 and the leucocytes 20,500 per cubic millimetre; the hæmoglobin value was 33% and the colour index 0·85; the platelets numbered 400,000 per cubic millimetre and 14·2% of the erythrocytes were reticulocytes. The jaundice was less.

On June 14 the following X ray report was received:

> There is an opacity above left diaphragm, rather small in extent, and extending up along axillary border—probably due to pulmonary consolidation. There is no definite fluid level; cardiac shadow is enlarged, particularly left ventricle.

On June 15 the patient was extremely restless and excited; her condition suggested anoxæmia. The jaundice was almost gone; hæmolysis appeared to be finished and a further transfusion of 600 cubic centimetres of blood with 100 cubic centimetres of citrate solution was given, with much improvement in the patient's general condition. The total amount of blood that she had received by transfusion was now 7,450 cubic centimetres. On June 18 the erythrocytes numbered 3,540,000 per cubic millimetre and the leucocytes 9,600. The hæmoglobin value was 48%, the colour index was 0·68 and the percentage of reticulocytes was 9·1. Of the leucocytes 79% were neutrophile cells, 3·5% were eosinophile cells, 13% were lymphocytes and 4% were monocytes. The platelets numbered 385,000 per cubic millimetre. The patient's temperature, pulse and respiration were normal. On June 26 the erythrocytes numbered 4,090,000 and the leucocytes 7,600 per cubic millimetre; the hæmoglobin value was 72%, and 3·6% of the erythrocytes were reticulocytes; of the leucocytes, 52% were neutrophile cells and 42% were lymphocytes.

On June 30 the Van den Bergh test elicited no reaction. On July 6 the erythrocytes numbered 3,950,000 per cubic millimetre, 4% being reticulocytes, and platelets numbered 515,000 per cubic millimetre. The leucocytes numbered 15,400 per cubic millimetre, 32% being neutrophile cells, 57% lymphocytes and 7% monocytes. On July 7 the leucocytes numbered 15,400 per cubic millimetre, 40% being neutrophile cells, 5% eosinophile cells, 46% lymphocytes and 9% monocytes.

On July 10 the report of the radiologist, Dr. Vote, was as follows:

> Œsophagus is normal in position, size and length—walls smooth and mucosa not dilated. No filling defects—no obstruction.
>
> Stomach: is placed well obliquely to the right. The pyloric pole appears to be directed along the under surface of the liver—its tone was increased and peristalsis rapid, but regular, also forceful and frequent. Gastric mucosa not unduly hypertrophied. I could detect no evidence of organic lesion of either stomach or duodenum.

On July 18 Dr. Shearman made another blood count with the following results: the erythrocytes numbered 4,160,000 per cubic millimetre, the hæmoglobin value was 60% and the colour index was 0·73; the leucocytes numbered 12,300 per cubic millimetre, 28% being neutrophile cells, 6% eosinophile cells, 11·5% monocytes and 54·5% lymphocytes. Some degree of variation in size was still present, and most of the erythrocytes were deficient in hæmoglobin; no nucleated erythrocytes or stippled cells were seen. There were no immature leucocytes.

On that day eosinophilia and lymphocytosis were more pronounced; both are considered normal after splenectomy.

On July 22 the patient was discharged from treatment and has been walking about quite strongly since then.

Comment.

A case of Banti's disease, in the early cirrhotic stage, with severe repeated hæmatemeses, is presented. It is interesting to note: (*a*) the splenomegaly, which was only moderate, and evident only after laparotomy; (*b*) the week of diarrhœa, the so-called "gastric 'flu", with slight hæmatemesis, and the nausea, which were in all probability gastro-intestinal disturbances in the course of the developing disease; (*c*) the low platelet count, even after a fairly large blood transfusion, and later the cessation of hæmorrhage, with a somewhat late rise of the platelets, following splenectomy; (*d*) the value of careful history-taking, in an attempt to arrive at a satisfactory diagnosis, especially in obscure or atypical conditions.

There were three points of special significance in present-day methods of treatment. These were the value of slow drip transfusion, which has been proved to be an extremely important procedure in cases such as this one, and the amount of blood used (6,850 cubic centimetres from over a dozen donors), the time taken being approximately sixty-nine hours.

Marriott and Kekwick (*The Lancet*, April 27, 1935), by means of continuous drip transfusion, proved it possible to give 5,600 cubic centimetres of blood over a period of fifty-one and a half hours, at an average rate of 133 cubic centimetres of blood per hour, thereby raising the hæmoglobin value from 20% to 88%. The ordinary transfusion of 500 cubic centimetres raises the hæmoglobin only by 8% to 10%.

The third point of significance was the value of immediate feeding in all cases of gastric hæmorrhage. Despite the vomiting of nine pints seven ounces of blood, no food was returned during the period prior to operation. This allowed the patient to maintain her body fluids. Her general condition, when operation became necessary, was consequently an extremely satisfactory one for the surgeon, who was presented with a "good risk" and not a "forlorn hope".

Reviews.

STRABISMUS.

To those of us who have in student and later days read one of the six previous editions of Worth's original work entitled "Squint", it seems almost a sacrilege that Chavasse should have given his new book a similar title with Worth's name included in it.[1] If Mr. Claude Worth had realized how drastically Mr. Bernard Chavasse would alter this excellent monograph, we wonder whether Mr. Worth would have ever given his consent to this work appearing under his name. The reading of Chavasse's book is like looking at a map

[1] "Worth's Squint or the Binocular Reflexes and the Treatment of Strabismus", by F. B. Chavasse, M.A., D.M.; Seventh Edition; 1939. London: Baillière, Tindall and Cox. Demy 8vo, pp. 712, with illustrations. Price: 25s. net.

of Australia in which the boundary and name of every State have been adjusted. He has introduced so many new terms and altered so many well-established ones that confusion becomes rife; when we come to conditions described as torsional secondary retino-proprioceptive correspondence we are left bewildered. That all normal and abnormal conditions of the ocular musculature should be explained in terms of Sherrington's and Pavlov's work is perhaps necessary, but the repetition of these theories makes the earlier part of this work monotonous.

After reading these 200 pages we come to Chapter IX, which is full of helpful suggestions on the diagnosis of ocular palsies and over-actions, and which points out the frequency of birth injury in producing these pareses and contractures. On the other hand, in Chapter X, dealing with the effect of excessive accommodation on squint, we hoped to find some really practical information; but instead we see that little of importance has been added to the previous edition, which has been quoted rather extensively. The author does here touch on anisometropia and does point out its prevalence in monocular accommodational squint, but he says nothing of the new experimental work at the Dartmouth medical school, New Hampshire, which has brought to light some extraordinarily interesting facts regarding the relation of aniseikonia to suppression. Chapters on secondary correspondence, diagnosis and treatment follow, while the last 55 pages are devoted to illustrative cases. We feel a few of these last pages could have been more profitably used in giving references to quoted authorities, of which we see too few. In fact we suggest that in a monograph of this type arranged references at the end of each chapter would have been more convenient for the reader.

To write a 680-page book on squint without a chapter devoted entirely to the phorias or convergence insufficiencies seems unfortunate; repeatedly to condemn orthoptics as "fiddling while Rome burns" is unjust and misleading; while to devote over 100 pages to operations in a total of 130 pages limited to treatment shows a definite bias. We cannot recommend the reading of this lengthy work to the busy ophthalmic surgeon.

TWO MEDICAL BIBLIOGRAPHIES.

MEDICAL PRACTITIONERS will welcome the appearance of bibliographies of the writings of two famous American medical men. One of these was the physician Sir William Osler, the other the surgeon Harvey Cushing.

The "Bibliography of the Works of Sir William Osler" is a second edition, much enlarged, of a first edition published in 1921.[1] The second volume, "A Bibliography of the Writings of Harvey Cushing", was a birthday present to the famous brain surgeon on his seventieth anniversary from the members of the Harvey Cushing Society.[2]

It is very fitting that these two volumes should come to hand at the same time, because during their lives these two great men were close friends, and after Osler's death Lady Osler placed her husband's papers in Harvey Cushing's hands and he wrote those two charming volumes which form an everlasting memorial of a great physician.

The first thought which comes to the mind of a reader when he glances through these volumes is one of amazement at the extraordinary industry which produced all these books and articles. Both authors were exceedingly busy men, had huge consulting practices which caused them to travel in many countries, and yet for fifty years Osler's pen never faltered; during this period he wrote hundreds of articles, reviewed innumerable books, prepared and delivered countless lectures and clinics, and with it all kept open house for medical men and students from all over the world. To quote an instance: Osler found time to spend two whole afternoons at the Bodleian Library during the busy war years with an Australian graduate who he knew was interested in medical history.

Harvey Cushing, whose splendid life has just ended, found time amid original work on brain tumours and brain surgery, which will give him a permanent place among the great ones of medicine, to write thirteen books and 306 articles of varied interest, many of them on historical subjects. In addition, a list of 328 papers by his assistants and pupils, which he personally encouraged or directed, is to be found at the end of the volume. These represent exactly forty years of unceasing activity.

The second thought is one of wonder that many Australian physicians and surgeons do not record their experience and are content "to be as though they had not been, to be found in the register of God, not in the record of man".

To return to the bibliographies; both books are beautifully produced and contain a portrait—that of Harvey Cushing is particularly pleasing. An interesting preface is supplied to the Cushing volume by Arnold Klebs, who writes most entertainingly about the "*Festschrift*" as a substitute for the birthday cake. The gift of such a volume he strongly recommends in place of the cake when the advancing years of the recipient make it difficult to fit the required number of candles on a cake.

The Osler bibliography has an introduction by Dr. Maude Abbott and an appreciation of Osler's work for students by a McGill undergraduate, in which he quotes a note pencilled in Osler's hand in one of his notebooks in the Osler Library at Montreal: "Experience is not to be measured by years but by the use made of one's opportunities." Osler certainly made magnificent use of his opportunities.

The medical book collector should not miss the opportunity of adding these two books to his library.

[1] "Classified and Annotated Bibliography of Sir William Osler's Publications (Based on the Chronological Bibliography by Minnie Wright Blogg)", edited by M. E. Abbott, B.A., M.D., LL.D.; Second Edition, revised and indexed; 1939. Montreal: The Medical Museum, McGill University. Medium 8vo, pp. 177, with illustrations. Price: $2.25 net.

[2] "Bibliography of the Writings of Harvey Cushing, Prepared on the Occasion of his Seventieth Birthday, April 8, 1939, by The Harvey Cushing Society"; 1939. Baltimore: C. C. Thomas. Medium 8vo, pp. 128. Price: $5.00 net.

A CLINICAL APPLICATION OF GESTALT PSYCHOLOGY.

"A VISUAL MOTOR GESTALT TEST AND ITS CLINICAL USE" is an application of the findings of the *Gestalt* school of psychology to the elucidation of problems of practical psychiatry.[1] A number of geometric patterns formed of series of dots, lines and other figures are used, which the subject is requested to copy. It is the thesis of the book that the perception of such patterns (configurations or *Gestalten* as they are technically called) undergoes a definite maturation process in the developing child and that in disease there is a regression to earlier maturation levels, which is of diagnostic significance. In normal children only formless scribbles are obtained before three years of age, but by eleven years the results approach the mature adult type; therefore the test measures the degree of maturity corresponding to normal age levels between three and eleven years. After the performances of normal children, mental defectives and primitive races have been investigated, characteristic types of response are shown to occur in sensory aphasia, *dementia paralytica*, alcoholic psychoses, traumatic psychoses, schizophrenia and manic-depressive psychoses. An attempt is then made to standardize the test as a performance test to obtain mental age levels in normal children and in mental defectives. Concluding chapters deal with typical productions by mental defectives, malingerers and the subjects of psychoneuroses.

The discussion opens up interesting lines of thought, and the test should provide an instrument to be considered in research projects, but is likely to prove of limited use in its present form in routine work. However, it seems worth while to experiment with it in this country.

[1] "Research Monographs of the American Orthopsychiatric Association. No. 3: A Visual Motor Gestalt Test and its Clinical Use", by L. Bender, M.A., M.D.; 1938. New York: American Orthopsychiatric Association. Crown 4to, pp. 186, with illustrations.

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All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

HARVEY CUSHING.

PARAPHRASING Carlyle, we may say that the history of medicine is but the biography of great men. Harvey Cushing, news of whose death has come from Newhaven in the American State of Connecticut, was a great man. He was great because when a young man he would not accept things as they were, but, uniting in his own person the knowledge and wisdom of the physician with the skill and audacity of the surgeon, he increased his knowledge, perfected his methods and made of cerebral surgery something new, vital and safe. Wherever in the whole world the story of surgery is told, there also shall he be named with the master surgeons of the past as one who added lustre to surgical achievement and brought relief to suffering humanity.

The history of cerebral surgery may be divided into two periods, before the coming of Harvey Cushing and after. It was in 1910 that Cushing, then associate professor of surgery at the Johns Hopkins University, Baltimore, in his William Mitchell Banks Memorial Lecture[1] showed what results might be expected from improvements in surgical technique. In this lecture he drew attention to the frequent occurrence of intracranial tumours and to the ease with which they might be overlooked; he showed that failure to recognize them in their early stages was one of the commonest diagnostic errors. He also expressed the opinion that neurological maladies were shunned by many physicians and more surgeons because of their presumed obscurity and therapeutic hopelessness. He reported that during the preceding ten months he had operated on sixty-four patients who were suffering from tumour of the brain. From twenty-three the tumour had been removed and sixteen patients recovered with more or less complete restoration of function. In forty-one instances a palliative operation had been performed, and only five patients died as an immediate result of operation; in many instances symptoms remained in abeyance for long periods. These surprising results must be attributed chiefly to accuracy of diagnosis and improved methods of technique. But Cushing foretold even a brighter future in the following words:

> Earlier diagnoses and more prompt interference, a wider experience in overcoming the technical difficulties of these cases, coupled with the courage to work slowly and painstakingly, these things will lead to increasingly better results in this responsible work, the success of which depends so greatly upon detail, patience, and the expenditure of time.

Cushing's prophecy has come true and he would be a bold man who would declare that no further progress can be made—that the goal of perfection has been reached. To state that the work of other men paved the way for Cushing and made extension of his work possible does not in any way detract from the brilliance of his achievements or the value of his contribution to surgery, for "great men are rarely isolated mountain peaks — they are the summits in the ranges". Edwin Bramwell has pointed out[2] that the first decade of the present century witnessed a remarkable expansion of the neurological horizon. With the coming of the

[1] *The Lancet*, January 8, 1910.
[2] *The British Medical Journal*, November 23, 1935.

century the day of pathological anatomy was passing, but the representation of function in the cortex continued to engage the attention of research workers. Sherrington and Leyton in 1901 published their experimental observations on the cortex of the higher apes; Vogts in 1902, Brodman in 1903, and A. W. Campbell in 1905 also studied the cytology of the cortex; but in 1905, with the appearance of Sherrington's great work, "The Integrative Action of the Nervous System", there dawned, as Bramwell declares, a new era, "for from this time onward the neurologist began to think more and more in physiological rather than in strictly anatomical terms". It was with this new outlook that Cushing began his work. Later came the newer diagnostic methods of ventriculography, encephalography and arterial encephalography. When Cushing at the International Neurological Congress at Berne in 1931 reported on the surgical mortality in a series of two thousand verified intracranial tumours, he showed how these methods of investigation had contributed to his extraordinary results. He also insisted that the operation was not the whole story, but that after-care was equally important—a contention which is recognized today in every neuro-surgical clinic. In spite of the remarkable progress made in surgical technique, it is noteworthy that Cushing stated that in another thirty years present operative procedures "will doubtless appear as crude to our successors as do those of thirty years ago to us".

What of the man himself? In this week's issue a short review is published of a bibliography of his writings. Here we read the facts of his life, set out in chronological order, together with the degrees and honours that were conferred upon him. Harvey Cushing is shown not only as a great American, but as an international figure, belonging to every nation, for universities and learned societies in every country vied with one another to do him honour. That we find here mentioned some thirteen books, some of which were translated into foreign languages, and upwards of three hundred addresses, papers and reports, reveals his zest, his untiring energy and his true scientific spirit. Arnold C. Klebs, who writes an introduction to this bibliography, states that to eyes that can see it presents a sort of cardiogram, recording not only the single beats, but also the subtle fusions of values which alone can make the masterpiece or picture the inner life of a writer. The hundreds of papers written by others, but inspired by him, are witness of his power as a teacher. From many countries came surgeons to serve an apprenticeship under him, to learn his methods at first hand and to disseminate his teaching. Their names are recorded in this book. The world of medicine, and particularly of neuro-surgery, stands indebted to the Harvey Cushing Society, of which Cushing was an honorary member, for this unique and valuable tribute.

Current Comment.

"G.A.C.C."

THE report of a scientific meeting which appeared in this journal a few weeks ago contained an account of the treatment by G. B. White of two patients suffering from pulmonary tuberculosis by the injection into the lung of a substance called "G.A.C.C.", the name being the initial letters of gelatin-acriflavine-calcium chloride. As this appears to be the first description of the use of this new medium in this country, it is of interest to trace its origin, development, modification and present position in the treatment of tuberculosis.

The use of gelatin-acriflavine compounds for the treatment of tuberculosis has always been associated with the name of R. A. Hunter, of Bridge of Weir, Renfrewshire. In the issue of *Tubercle* of February, 1931, shortly after the injection of oil into the pleural cavity had been put forward as a treatment for tuberculous pyopneumothorax, he pointed out that the oils generally employed, usually mixtures of olive oil and various medicaments, would not mix with the fluid in the chest and possibly formed suitable pabulum for the tubercle bacillus; and he made experiments to find a substitute which would be both miscible with the pleural fluid and antiseptic. Gelatin dissolved in saline solution in the proportion of five parts per hundred was found to be a medium meeting the requirement of miscibility; acriflavine was added as the antiseptic, the dilution employed being one part in 2,000. The preparation was found to be lethal to tubercle bacilli and other pyogenic organisms, and "gelatinothorax" was suggested as a new and suitable treatment for tuberculous disease affecting the pleural cavity. Little further was heard of gelatinothorax until 1934, when Hunter and D. Bell described an experimental study

on induced deposition of calcium in lung tissue.[1] They stated that gelatinothorax had become the routine treatment at the Bridge of Weir Sanatorium for tuberculous empyema or pleural effusion, that the effect was in most cases a distinct improvement in the condition of the patient, and that their study had been undertaken in an effort to understand the manner in which the treatment operated. The first step was to establish gelatinothorax in rabbits suffering from mild chronic pulmonary tuberculosis produced artificially, and it was observed that the treatment caused much hyaline connective tissue to appear in the pleura and subpleural tissues. While this experiment was in progress it was decided to incorporate calcium chloride in the medium with a view, firstly, to its retention and deposition in the pulmonary parenchyma, and, secondly, to stimulate the formation of fibrous connective tissue *pari passu* with the bactericidal action of the acriflavine. Thus it was hoped to imitate the natural healing process in tuberculosis, wherein calcium salts are deposited in foci of disease which have become isolated by a zone of connective tissue so dense as to interrupt the osmosis by which alone the tissue of the lesions gains its sustenance. The new medium containing calcium chloride was named "G.A.C.C." Several guinea-pigs which had received lethal doses of tubercle bacilli were treated with intrapleural injections of "G.A.C.C." on the right side, and it was found when the animals died that hyaline tissue was present in the right lung, especially in the subpleural zone, and that in this tissue the deposition of lime salts was occurring. The left lungs of the animals were not affected by the treatment. A healthy rabbit which already had gelatinothorax and which was similarly treated, remained very healthy, and when killed was found to have dense calcification of the right pleura and subpleural tissues.

When these encouraging results were obtained it was decided to carry out further experiments, injecting "G.A.C.C." actually into the lungs of animals, with a view to evolving a method whereby the pulmonary parenchyma or, more particularly, tuberculous lesions deep in the lung substance might be subjected to a more intense action by the compound than would be possible by intrapleural injection. Five healthy rabbits were treated with intrapulmonary injections of "G.A.C.C." The injections were very well tolerated and produced widespread irregular calcification of the treated lung; in one animal calcification was present seven days after the commencement of the treatment. Tuberculous animals were similarly treated with much the same results as those obtained in the healthy animals, some of the calcium being deposited in the tuberculous lesions. It appeared that the effect was a purely local one, confined to the lobe of the lung injected. There was reason to think that hyaline change in the lung tissue always precedes calcification, that this hyaline change is the actual healing process by which the affected tissues are transformed into a homogeneous mass of very little vitality, and that in the hyaline tissue the physical conditions lend themselves to rapid calcification, provided that a supply of lime salts is available. In 1935 Hunter[1] was able to show histologically that the effects of intrapleural injection of "G.A.C.C." are much the same in man as in animals, and in 1936 he showed[2] that hyaline change and calcification in the Jensen rat sarcoma are consistently effected by parenteral injections of "G.A.C.C."

It was not until 1938 that any further account was published of the use of "G.A.C.C." for the treatment of pulmonary tuberculosis in man, when Hunter and E. J. Peill,[3] in a paper of which an abstract appeared in this journal on March 19, 1939, reported the histories of three patients whose condition had greatly improved after intrapulmonary injections of the compound, and also alluded to a number of other cases. The details of the cases were not set out clearly, fully or systematically enough for the report to carry conviction as to the value of the treatment or to convey any precise idea of its effects; but at least it was shown that the intrapulmonary injections are harmless, provided that care is taken not to give the injection into the lumen of blood vessels, for 180 were given without any ill effect other than slight transient pyrexia. In this paper Hunter and Peill announced that they had discarded the original "G.A.C.C." in favour of a modification containing six times as much gelatin, which would tend, when injected into a cavity, to remain intracavitary and block the draining bronchus, thus promoting absorption of the contained air. They gave full directions for the preparation of the modified compound, which they called "G.A.C.C.'B.'", and which on account of the large proportion of gelatin in its composition must be injected at a temperature not less than 80° C. Apparently no sensation of this heat is appreciated by the recipient. It was presumably "G.A.C.C.'B.'" that was used by White in the treatment of his patients. The original preparation has recently been recommended by Hunter[4] for use in the treatment of tuberculous adenitis by intraglandular injection. (An abstract of this paper appeared in this journal in the issue of May 27, 1939.)

This new treatment, although there is so far no record of its clinical application, except the rather meagre accounts here mentioned, rests upon such an impressive experimental and theoretical background that it is certain to receive extensive trial; in fact we understand that it is already in use in several centres in Australia and New Zealand. Hunter and Peill have enjoined their readers against modification of the medium or departure from their directions for its use. It is certainly to be hoped that we are not to witness the introduction for the treatment of human illness of a host of modifications whose properties are less carefully established by animal experiment than those of the original preparations.

[1] *Tubercle*, October, 1934.

[1] *Tubercle*, August, 1935.
[2] *The Journal of Pathology and Bacteriology*, July, 1936.
[3] *The British Journal of Tuberculosis*, July, 1938.
[4] *Tubercle*, January, 1939.

Abstracts from Current Medical Literature.

GYNÆCOLOGY.

The Treatment of Kraurosis, Leucoplakia and Pruritus Vulvæ.

GEORGE L. FOSS (*The Journal of Obstetrics and Gynæcology of the British Empire*, April, 1939) has treated, chiefly with œstradiol benzoate, forty-eight patients suffering from kraurosis, leucoplakia and pruritus. In 1936 he used five milligrammes twice a week by injection and *dragées* of 0·1 milligramme four times a day. Since then he has greatly increased the dosage. Once relief is obtained dosage can be reduced gradually, being maintained for a while at the minimal optimal dose which will keep patients free from irritation, and reduced further in gradual stages. In some cases a decrease in the dosage precipitates uterine bleeding, even in elderly women. After such bleeding it is advisable to delay further injections for a time and to continue the local treatment only. The œstrogenic hormone probably acts by damping down the gonadotropic pituitary hormones. The routine treatment was injections of ten to twenty-five milligrammes of œstradiol benzoate at the start, at least twice a week. If possible, daily or still more frequent injections hasten the improvement. Vaginal suppositories of œstradiol, œstradiol cream applications, and in some cases tablet implantation of œstradiol or œstrone were used. In addition, hydrochloric acid and vitamin *A* were at times administered. Very few patients achieved complete and lasting comfort, and nearly all of this series had slight relapses, which were quickly controlled by further local therapy and injections. The more severely affected patients needed almost continuous substitution therapy, but in most cases suppositories or ointment maintained good comfort.

Syphilis and Carcinoma of the Cervix.

M. SORBA (*Monatsschrift für Geburtshülfe und Gynäkologie*, May, 1939), from an investigation of 262 cases of uterine carcinoma, found that 15% were syphilitic as compared with a general incidence of 1·6%. He considers that syphilis may play a part in the ætiology of cervical carcinoma, although accurate clinical diagnosis is not made either because no biopsy is performed or syphilis is not considered. The number of cases of cancer following syphilitic lesions other than leucoplakia are too small to enable any definite opinion to be formed as to the ætiological role of syphilis. Comparison of cancer groups—syphilitic and non-syphilitic—shows no difference as to age incidence, histological type of growth and prognosis. There appears to be a preponderance of *nulliparæ* among the patients. Further investigations are required to determine whether the above-mentioned results have a general application.

Masked Hypothyreoidism as a Cause of Amenorrhœa.

E. C. DODDS AND J. D. ROBERTSON (*The Journal of Obstetrics and Gynæcology of the British Empire*, April, 1939) draw attention to certain cases of secondary amenorrhœa resistant to substitution therapy in which there is a subnormal basal metabolic rate and in which adequate treatment with thyreoid extract raises the basal metabolic rate to normal and menstruation recommences. Secondary amenorrhœa may be due to a variety of causes, including local lesions, general debilitating disorders, nervous influences, endocrine disturbances or a simple ovarian hormone deficiency. Of the endocrine disturbances causing amenorrhœa, myxœdema, thyreotoxicosis, acromegaly and pituitary basophilism are easily recognized, and so it has become the habit to treat patients with amenorrhœa not showing any of the well-marked signs of generalized disorder by substitution therapy, sometimes unsuccessfully. The authors describe three cases which were considered to be cases of secondary amenorrhœa of over two years' duration due to ovarian deficiency; the patients were treated by replacement therapy with œstrogenic and progestational hormones without success. The basal metabolic rate was found to be −20% or lower in each case. Treatment with thyreoid extract was successful. In one case in which the dose of thyreoid extract was reduced and the basal metabolism as a result fell below normal, amenorrhœa reappeared, but menstruation again returned when an adequate dose of thyreoid extract was given to raise the metabolism to normal.

Uterine Hæmorrhage Induced by Oral Administration of "Pregneninonol".

P. ZONDEK AND S. ROSIN (*The Lancet*, March 4, 1939) succeeded in initiating uterine hæmorrhage in normally menstruating women during the intermenstrual stage by the intramuscular injection of ten milligrammes of progesterone daily for five days, beginning shortly before menstruation. They further demonstrated that in secondary amenorrhœa bleeding could be induced with fifty milligrammes of progesterone without preliminary treatment with œstrogenic hormone. In primary amenorrhœa progesterone therapy is a failure, demonstrating a characteristic difference between primary and secondary amenorrhœa. Oral administration of œstrogenic hormone is one-fifth as efficient as the same dose by parenteral administration. Oral administration of progesterone is ineffective. It has been claimed that a new preparation, "Pregneninonol", has a progesterone-like effect in both man and animals when taken *per os*. In normally menstruating women the authors have been able to induce uterine hæmorrhage during the intermenstrual stage by giving "Pregneninonol" *per os* in the post-menstruum. In secondary amenorrhœa hæmorrhage was induced by oral administration of "Pregneninonol" without preliminary treatment with œstrogenic hormone. The effective dose of "Pregneninonol" given by mouth is about six times greater than the effective dose of progesterone given by intramuscular injection.

Male Sterility.

K. JOËL AND O. J. POLLAK (*Monatsschrift für Geburtshülfe und Gynäkologie*, May, 1939) have conducted a systematic investigation of the resistance of human spermatozoa to various chemical agents, in order to determine a useful test for the viability of spermatozoa in cases of sterility. The male partner was to blame in 25% of the authors' cases. In such cases, when motility was impaired, they found that isotonic solutions of magnesium salts frequently revived the spermatozoa and enabled a better study of any abnormalities to be made. Naturally other factors were also observed—the total number of spermatozoa in a field, the numbers which were mobile as well as those apparently normal in structure. In this way abnormal ejaculations can be studied as regards the degree of motility of the sperms.

OBSTETRICS.

Excretion of Œstrogenic Hormones during Pregnancy.

E. DINGEMANSE, E. LAQUEUR AND O. MÜHLBOCK (*Monatsschrift für Geburtshülfe und Gynäkologie*, April, 1939) describe their investigations into the excretion of œstrogenic hormone during pregnancy and labour. The amount excreted seems to vary individually, and in the first half of pregnancy ranges between 15,000 and 80,000 units per litre. The hormone is of two kinds—one (œstrone) combined with a ketone group, and the other free (œstriol, œstradiol); 98% is excreted in the combined form during pregnancy. Shortly before labour the free form, excreted rapidly, increases and continues so after the onset of labour. This points to a sensitization of the uterine muscle by the uncombined hormone and may represent the real cause of the onset of uterine contractions.

Outbreak of Streptococcal Peritonitis in Infants in a Maternity Ward.

G. J. CRAWFORD AND L. STENT (*The Journal of Obstetrics and Gynæcology of the British Empire*, April, 1939) record four fatal cases of streptococcal peritonitis in a maternity ward. The babies were all born during a period

of nine days. Bacteriological examination of the chalk used for dressing the umbilical cords, the ligatures and the dressings gave negative results. None of the nursing staff or mothers showed septic spots or any skin lesions likely to convey infection. Each of the mothers had a normal puerperium. In three cases the mothers' throat and nose swabs were incubated and no hæmolytic streptococci were grown. Among the thirteen nurses involved, three were throat carriers of hæmolytic streptococci, but not of the type recovered from the babies' peritoneal cavities. A fourth nurse had a copious growth of hæmolytic streptococci from both throat and nose, and these proved to belong to type 28, the type which caused three of the deaths. In the other infant the organism was not typed. This nurse was a junior nurse and so was not allowed to bathe the babies or to dress any umbilical cords, but she handled the babies and changed their napkins. It would appear that the infected nurse was the direct or indirect cause of the peritonitis in the babies; but the authors recognize that the evidence is merely suggestive and by no means proven.

The Use of "Pentothal Acid" for Obstetrical Analgesia.

G. C. STEEL (*The Lancet*, July 29, 1939) has administered "Pentothal acid" orally to 200 women in labour at the Middlesex Hospital with results described as very good. He states that labour is not prolonged; that the patient sleeps between the pains, waking up refreshed and fully *compos mentis* as they occur; that the degree of analgesia obtained is good and that there is also some amnesia, but not to an undesirable degree—most women do not want the birth of their child to be an "absolute black-out" in their memory. The patient is almost always cooperative during the delivery. Respiratory depression in the child does not occur. A dose of six to eight grains (one and a half to two tablets) of "Pentothal acid" is administered when the pains begin to cause real discomfort, and this dose is repeated three-quarters of an hour later; thence until as near to delivery as is convenient for its administration a dose of two to four grains is given every half to one hour. The author administers gas and air also at some time during the second stage, and states that it is towards the end of the second stage that the value of the "Pentothal acid" becomes most apparent.

The Excretion of Free and Acetylsulphanilamide in Human Breast Milk.

L. R. HAC, T. L. ADAIR AND H. C. HESSELTINE (*The American Journal of Obstetrics and Gynecology*, July, 1939) have carried out an investigation to determine whether prolonged use of sulphanilamide at therapeutic blood levels would result in an accumulation of the drug in breast milk sufficient to be detrimental to the nursing baby. In a previous paper they showed that the sulphanilamide in the milk was at much higher concentration than that in the blood, but that the highest amount excreted in the milk was only 1·5% of that ingested. Since it is known that, at least in animals, the toxicity of acetylsulphanilamide is greater than the free sulphanilamide, it was decided to study the comparison of both free and acetylsulphanilamide of the blood, milk and urine. It was found that the level in the milk was considerably higher than that in the blood. The percentage of the sulphanilamide excreted in the conjugated acetyl form was relatively low on the first day the drug was administered, increased slightly on the second and third days, and rose sharply on the fourth and fifth days, when administration of the drug had been discontinued; the same was observed in blood and urine. The authors come to the conclusion that as only 1·6% of drugs was excreted by the breast, no harmful results to the baby would follow. However, in the present investigation the blood level was not raised above 5 millimetres per 100 cubic centimetres, as it was thought that the patient in whom it would be desirable to maintain a higher blood level would be too ill to feed her babies.

Surgical and Radiation Therapy in Carcinoma of the Corpus Uteri.

W. P. HEALY AND R. L. BROWN (*The American Journal of Obstetrics and Gynecology*, July, 1939) report 197 patients with carcinoma of the *corpus uteri* who were treated and followed up for at least five years or till death. Approximately half the patients received radiation alone, and the other half were treated by a combination of surgery and deep X ray therapy; only eight patients were subjected to surgery alone. The ages of the patients ranged from 19 to 79. The average age was 58. The period of greatest incidence was from 55 to 64. Of the patients, 36% were multiparous, as a contrast to carcinoma of the cervix, in which 90% were multiparous. Hæmorrhage was the outstanding symptom and was present in 98% of the cases. The bleeding was generally post-menopausal, intermittent and slight at first, tending to become more constant and profuse as time went on. Pain was a symptom of prognostic significance, even though no visible spread was present at the time of operation; 66% of the patients who had this symptom died of carcinoma, whereas of 144 patients without pain, only 37% died of carcinoma. Of the 101 patients subjected to abdominal operations, 38 had associated fibromyoma. The relationship of the size of the uterus to prognosis was studied, and it was noted, as expected, that prognosis had a definite relationship to the size of the uterus. When the uterus was not enlarged more than a two and a half months' pregnancy the five-year survival rate was 60% and became progressively more with an increase in size. The authors show that when surgery could not be employed, irradiation by the intrauterine use of radium was able to give a 39% cure; but they have been able to obtain a 79% five-year cure with a combination of panhysterectomy after intrauterine irradiation. As a contrast they quote Arneson, who recently reviewed the literature on the surgical treatment alone of cancer of the uterine body, and found that in 927 reported cases only 57% of the patients were living after five years or more. Accordingly a claim is made for the value of the combined treatment.

The Remote Prognosis of the Toxæmias of Pregnancy.

F. J. BROWNE AND GLADYS H. DODDS (*The Journal of Obstetrics and Gynæcology of the British Empire*, June, 1939) report on patients suffering from toxæmia of pregnancy followed up for periods varying from twelve years to six months. Four hundred patients are studied in 589 pregnancies. The patients are placed in preeclamptic toxæmic, eclamptic, hypertensive, chronic nephritic, and recurrent toxæmic groups. Chronic glomerular nephritis did not supervene in any patient. The residual lesion after preeclamptic toxæmia was invariably hypertension, and this resulted in 50·9% of cases. Generally, the older the patient, the greater her parity, the higher the blood pressure during the pregnancy, and the longer the duration of the illness before delivery, the greater was the danger of residual hypertension. In eclamptic patients also the greater the number of fits, the greater the danger. Chronic glomerular nephritis did not occur in any patient as a result of eclampsia. The residual lesion after eclampsia was also hypertension, which resulted in 60·8%. Of the hypertensive patients, 9·2% were dead within the twelve-year period. It was suggested that the majority of patients, however, who have simple hypertension pass through pregnancy without any demonstrable deterioration in their general condition. Chronic nephritis complicating pregnancy is rare, the ultimate prognosis is usually bad, and 29·4% of patients died in the period under review. In most cases of recurrent toxæmia the patient has hypertension during the interval between pregnancies. The remainder are "potential hypertensives", and it is suggested that in all these patients there is a familial hypertensive tendency. This suggests that patients who develop residual hypertension after preeclamptic toxæmia and eclampsia have a familial tendency to the disease, which pregnancy has merely revealed and the onset of which the pregnancy has hastened, so that it sets in at an earlier period than it would have otherwise done.

Special Articles on Civilian War Casualties.

VII.

THE TRANSFUSION OF STORED BLOOD: SOME OBSERVATIONS ON THE ORGANIZATION OF A BLOOD TRANSFUSION SERVICE IN TIMES OF NATIONAL EMERGENCY.[1]

The Advantages of Blood Transfusion.

THE purpose of this paper is to review the present state of our knowledge on the collection, storage, transport and administration of blood, and to discuss a plan for organizing a blood storage service should a state of national emergency arise.

The advantages of blood transfusion are well known. After a severe hæmorrhage a blood transfusion supplies the depleted circulation with a fluid of correct osmotic pressure and viscosity. The blood volume is thus both restored and maintained. Moreover, the injected red cells relieve the anoxæmia by carrying a high concentration of oxygen. The transfused blood also contains a supply of immune bodies, and Kolmer[(1)] holds that this increases the recipient's resistance to infection, especially if he is suffering from chronic sepsis.

A transfusion of blood is by far the best means of restoring the circulation after severe blood loss. However, when blood is not available the intravenous infusion of 5% glucose in Ringer's solution or normal saline solution is of definite benefit. Also, a liberal supply of the fluid by mouth and by the rectum greatly aids the body in the restoration of blood volume. This fact was clearly shown during the Great War.[(2)]

The introduction of a method of storing blood, so that an ample supply may be available for instant use during times of civil or military emergency, has proved to be a life-saving procedure. The advantages and disadvantages may be summarized as follows.

Advantages of Stored Blood.

1. Time is saved in the collection of blood when stored blood is available. Under ideal conditions it takes at least half an hour to collect a pint of blood by the time the apparatus and the donor are prepared, the blood is run into a special container, and the donor is finally dealt with. Moreover, the difficulty of calling suitable donors and catering for their transport is a problem even in peace time. Finally, the sudden removal of donors from their work may tend to disorganize industry.

2. Large volumes of blood from universal donors (Moss's Group IV—International Group *O*) can be stored and made available for immediate use. In a grave emergency blood could be given without the necessity of waiting until the recipient's[(3)] blood group was determined.

3. The rise in hæmoglobin value that follows the transfusion of stored blood appears to be the same as when fresh blood is used, and there seems to be no greater tendency for reactions to occur.[(4)]

The Disadvantages of Stored Blood.

The disadvantages of stored blood are the following: The red cells have a shorter life (Filatov),[(5)] the immune bodies are reduced during storage (Kolmer),[(1)] and there is a remote possibility of the blood being contaminated in spite of rigid aseptic precautions.

Historical.

It is stated by Keynes[(6)] that the first human blood transfusion was given by Jean Denys in 1667. The introduction of sodium citrate by Lewisohn and Hustino, in 1914, greatly simplified the giving of blood. During the latter years of the Great War, blood was collected from donors and stored in refrigerators in preparation for use.[(2)]

In 1937 the Russians advocated the use of blood from cadavers, and the recent Spanish Civil War has given a great impetus to the study of blood storage as the result of excellent work by Jorda[(3)] and others. In 1937 a "blood bank" was formed in the Cook County Hospital by Fantus[(7)] and his fellow workers. Medical practitioners could contribute blood to the bank in order to establish a credit balance. A corresponding amount of blood could then be withdrawn from the bank at any time when the occasion demanded. Somewhat similar schemes have now been developed throughout the world, and blood storage has proved to be a practical and successful undertaking.

The indications for blood transfusion in time of war will not be discussed in this paper. However, it is of interest to note the following statement by Jorda[(3)] during the Spanish Civil War (1938):

> In many patients blood transfusions were carried out at the commencement of a surgical operation and immediately after it, as for example in cases where a limb had been torn off, when the loss of blood is very great and the shock dangerous. In other cases it has enabled us to carry the decision in favour of preservation to an extreme and to save several limbs which without meticulous care would have been condemned to amputation.

It has been estimated that with modern warfare about 25% of all operations for the repair of war wounds call for blood transfusion.

The Source of Blood.

The most satisfactory source of blood for storage is from healthy adults. In Russia, Yudin[(8)] and others have advocated the use of cadaver blood. It is found that after sudden and violent death spontaneous fibrinolysis takes place and therefore no anti-coagulant is necessary. Blood is collected aseptically from the jugular vein in the neck. During the Spanish Civil War Jorda[(3)] found that it was far more satisfactory to use living donors.

Placental blood has also been stored; but its use appears to be limited by the danger of infection, by the relative scarcity of the supply, and by the possibility of extracting foreign protein material. Moreover, only about 80 cubic centimetres of blood can be obtained from each placenta (Vaughan).[(9)] Maoji Kiguchi has described a process for "drying" blood. The resulting powder is redissolved in saline solution. Recent reports of this process are not favourable.[(10)]

Alternative Fluids for Infusion.

It is also important to consider the other types of fluid which can be infused into the vein of a patient suffering from shock, exsanguination or dehydration when blood is not available. These are blood plasma, blood serum, ascitic fluid, dried serum (lyophile) which is redissolved,[(11)] Ringer's solution and normal saline solution. It should again be emphasized that, contrary to previous beliefs, intravenous injection of glucose in Ringer's solution or of glucose in saline solution will often aid a patient suffering from surgical shock. Reports from the Spanish Civil War and the war in China have verified this. It should be noted (*vide infra*) that after blood has been stored for two to three weeks the red cells begin to be hæmolysed. The plasma can then be drawn off and stored for many more weeks. Plasma transfusion is second only to blood transfusion as a method of restoring blood volume after hæmorrhage and shock. It is the best fluid to use in cases of shock without hæmorrhage, burns and nephritis.

The Selection of Sites for Blood Storage Units in a National Emergency.

In capital cities such as Melbourne, where there are six or more major hospitals, it is wise to have from three to six blood storage depots in case of demolition. The depots should be at the hospitals, as here there will be the greatest demand. Similar blood storage units should

[1] A lecture delivered under the auspices of the Melbourne Permanent Post-Graduate Committee on July 27, 1939. The work connected with this paper was carried out under a grant from the National Health and Medical Research Council.

be established in country towns specially chosen because of their population, geographical and strategic importance, and the efficiency and size of their hospitals.

Each unit should be self-contained with regard to staff, equipment and refrigeration. The staff should be trained to type the blood of donors and patients, to prepare and sterilize the special preserving solution and apparatus, and to collect blood from the donors and test it for blood grouping, sterility and Wassermann reaction. The personnel of this staff could be made up from medical men above military age, medical women, medical students, females with a science degree, female technicians and male technicians below military age. In preparation for a national emergency it would be wise to have a number of medical students and medical men of military age trained in the technique of blood collection and storage, as they may have to take an executive part in the event of a national emergency. These should be approved of by the military authorities. A special course of training could be held at the established blood storage centres. All the personnel mentioned above could attend.

Donors.

The blood groups of a large number of individuals should be determined, so that in the event of a national emergency they could act as donors. In the civil population the following persons could act as donors: youths aged between fifteen years and the war age (eighteen years), males older than the war age and aged under seventy years, females between the ages of fourteen and seventy years, males of the war age who are unfit for military service owing to a physical debility which does not interfere with the blood—for example, infantile paralysis and club foot.

When possible donors should be employed in the hospital associated with the blood storage unit as members of its nursing or domestic staff, or they may live near to the hospital so that they may be called without delay. It would be wise to have other donors available in the outlying districts so that they could be called to the nearest depot or visited by a mobile blood-collecting unit.

A card index record system should be kept at each hospital, stating the names of the suitable donors together with their address, telephone number, blood group, results of physical examination, the state of their veins and the date of previous blood-giving. The names of the suitable donors both in the surrounding district and in the outlying districts should be recorded at each blood storage unit. In addition a central bureau for donors should be established in Melbourne which would possess a duplicate of the records of all donors attached to all the blood storage units. In Melbourne this bureau would assist the local bureaux and correlate their work. It would take over their function temporarily in the event of the hospital or blood storage unit being demolished and arrange for the donors to be attached to another blood storage unit.

Examination of Donors.

Each donor should be medically examined and a note made of his past illnesses, especially syphilis and malaria. The size of the veins at the elbow should be recorded. In Spain an X ray photograph was taken of the chest.

Determination of Blood Groups of Donors.

The blood of donors should be typed with stock samples of typing serum of Groups II (*A*), III (*B*), IV (*O*). At present it would be wise to use this combination of the Moss and international nomenclatures (1 = *AB*, II = *A*, III = *B*, IV = *O*). In Spain, when 28,900 persons were tested, it was found that the blood groups were distributed in the following frequency:[(5)]

Group I (*AB*)	4%
Group II (*A*)	46%
Group III (*B*)	9%
Group IV (*O*)	41%

It is probable that a somewhat similar distribution is present in Australia. Nearly half the donors tested will thus be universal donors belonging to Group IV (*O*).

The Advantages of Group IV (O) Serum.—Jorda,[(6)] working in the Barcelona Service, found it both practical and highly desirable to use only blood from universal donors. This obviated the necessity for typing the blood of the recipient during times of emergency. The disadvantage of using only Group IV (*O*) blood is that it restricts the number of suitable donors. Another possible disadvantage is that if a large quantity of Group IV (*O*) blood is given to a patient belonging to Group I (*AB*), Group II (*A*), or Group III (*B*), the serum of the donors may reach a sufficient concentration in the recipient's blood stream to produce agglutination. Jorda holds that the possibility of this occurring is very remote, as the serum of most Group IV (*O*) donors does not contain a high agglutinating titre. When the blood from several donors is pooled it would be rare to have more than one donor with high titre serum; therefore the resulting mixture would always be of low agglutinating titre. He has shown that most pooled blood has an agglutinating titre of less than 1:32. High titre agglutinating serum reaches 1:100 or even 1:200. Moreover, he has injected up to three and a half litres of Group IV (*O*) blood into a patient belonging to Group II (*A*) without any ill effects.

General Considerations.

It is essential to instil the spirit of national service into the donors. In Spain they were repaid for their service with a tin of condensed milk.

In times of grave emergency it would be possible to call on a donor every six to eight weeks. It would be wise to give an iron tonic in the interim (Vaughan) to aid blood regeneration.

The amount of blood taken from each donor will be influenced somewhat by the weight and physical fitness of the donor, the size of his veins and the skill of the operator. Most authorities advise the collecting of 300 to 400 cubic centimetres. It would appear that in Australia, at least, the average donor could give at least 500 to 700 cubic centimetres. The total yield of blood would thus be far greater, and the saving of time, apparatus and laboratory space would be considerable. Collapse or distress on the part of the donor will be rare, even though 600 cubic centimetres are collected, if his attention is engaged in animated conversation, if his skin is infiltrated with local anæsthetic, if the needle is placed straight into the vein without any fruitless and painful thrusts into the surrounding tissues, and finally if the blood is collected with the aid of slight negative pressure. In the event of war, when the donors may be harassed by months of mental and physical stress and weakened by under-nutrition, a smaller quantity may have to be collected.

When the demand for blood is not great and transport is available, it would be wise to use donors from outlying districts. Only blood stored for nearly the limit of time should be used so that the stores are constantly being built up with fresh blood. During a crisis the bank should be conserved; blood should be collected from donors and given immediately by the usual technique of a routine blood transfusion. This lessens the work of the blood storage unit. When the stored blood begins to be hæmolysed and there are no patients requiring it, the plasma should be drawn off and stored ready for intravenous infusion or for purposes of typing, should it be of high agglutinating titre.

The Typing of Blood.

Serum for Typing.—It is essential to use only samples of typing serum of high agglutinating titre in order to minimize the risk of making an error. The serum should have a titre of at least 1:100 (Vaughan).[(3)] Stores of blood belonging to Groups II (*A*), III (*B*) and IV (*O*) are being collected and stored at the Commonwealth Serum Laboratories, and these could be distributed to the country centres in times of national emergency. Stored samples of typing serum should be tested at monthly intervals for fall in titre and discarded if necessary. A parent sample could be kept under adverse conditions at the main depot and tested at intervals; should this deteriorate the owners of stocks could be notified. At present the Director of the Common-

wealth Serum Laboratories, Dr. Morgan, is investigating this problem and also the use of an antiseptic (0·01% sodium ethyl mercurithiosalicylate) to minimize the risk of the serum becoming infected. Finally, it is essential to have donors possessing blood of high agglutinating titre (at least 1:100) employed at the blood storage depot or domiciled close to it. They will act as donors of typing serum in times of an emergency. Their blood should be conserved and withdrawn only when serum from other sources is not available. Their names should be recorded at the bureaux of all the blood storage depots.

Technique of Typing.—The technique of typing is well known. High titre serum should be used (at least 1:100). Serum from Groups II (*A*), III (*B*) and IV (*O*) should be used. Serum of Group IV (*O*) is used as a check on the potency of serum of Groups II (*A*) and III (*B*) (Gardiner).[20] Should corpuscles be agglutinated by Group IV (*O*) serum, then they should always be agglutinated by the serum of Groups II (*A*) and III (*B*).

The Collection of Blood from the Donor.

The blood should be collected by members of the blood transfusion unit who have been specially trained in venous puncture and aseptic technique. The blood should be collected at the blood storage depots and possibly at other places if a mobile unit is available (*vide supra*).

Apparatus.—Many designs have appeared recently in the literature of apparatus for collecting blood. Most of them consist of a sterile glass reservoir fitted with a rubber bung. Blood is collected from the vein with a large bore needle and conveyed to the reservoir by a short length of gum rubber tubing. The flow is usually aided by slight negative pressure produced by a pump of the Higginson variety (reversed to produce suction). Details of a model suitable for use in times of national emergency will be submitted for publication in the near future.

Technique.—The following technique has been developed for collecting blood from the donor. It is designed to produce a maximum average yield with a minimum of discomfort to the donor. By far the most difficult part of a blood transfusion is the introduction of the needle into the lumen of the vein with the first thrust and the avoidance of pain to the donor. The other factor which may limit the yield is fainting on the part of the donor. This is reduced to a minimum by the following means: always insist that the donor should lie down, use local anæsthetic at the site of the venous puncture and engage the donor in animated conversation. Finally, a confident manner on the part of the operator and his assistants is most important.

1. The donor should have a high carbohydrate meal or drink prior to giving blood. A meal rich in fat makes the plasma thick.

2. He should be lying down with his arm abducted at a right angle and resting comfortably on a narrow table or arm rest.

3. All clothing should be removed from the arm.

4. A sphygmomanometer is applied to the arm close to the axilla. The inflation and manometer tubes should point proximally so as not to hinder the operator.

5. The flexure of the elbow is sterilized with ether, iodine or "A.C.M.".

6. The manometer is inflated and the donor instructed in the method of firmly opening and closing his hand without pronating or supinating the forearm, which would alter the position of the vein relative to the overlying skin. A mid-prone position of the forearm is usually the most satisfactory position.

7. The manometer is inflated to 60 millimetres of mercury. This is sufficient. A greater pressure gives more discomfort to the donor and so should be avoided.

8. The donor's fist is clenched and a suitable vein is selected by inspection and palpation. A superficial longitudinal scratch half an inch (13 millimetres) in length is made along the length of the vein at the site selected. This clearly defines the position of the vein even after the local anæsthetic has been injected.

9. The manometer is deflated. This means a rest for the donor and also lessens the bleeding during the next few stages (10 and 11).

10. About two minims of a local anæsthetic (a 2% solution of "Novocain", "Ethocain" or "Planocain") are injected intracutaneously and subcutaneously around the centre of the scratch (see 8) and the skin is massaged so that the anæsthetic is diffused.

11. A small incision, about a quarter of an inch in length, is made through the skin along and at the centre of the scratch. The subcutaneous tissues can be gently torn aside by the points of curved mosquito forceps inserted through the incision and opened. This will be facilitated if one edge of the incision is gently elevated with dissecting forceps. The superficial surface of the vein will then be seen.

12. The manometer band is again inflated to 60 millimetres of mercury, and the donor clenches his hand. The large bore needle is thrust into the vein in a distal direction so as to be pointing against the direction of the blood flow. (The blood will probably flow just as freely if the needle points proximally owing to the free venous anastomosis). It is easier to insert the needle when the bevel is uppermost and the blood flows freely.

It is essential that the point of the needle should be very sharp. It should be sharpened after every operation. The members of the transfusion team should be trained in the method of sharpening needles (an "Arkansas" stone and fine emery paper are the best for this purpose).

13. When the needle has entered the vein the blood will be seen to flow down the transparent rubber tube into the collection flask. It should enter the flask in a continuous stream.

14. The blood collecting flask is held by an assistant seated on a low chair on the opposite side of the donor's outstretched arm. The flask is gently but constantly shaken so that the blood is thoroughly mixed with the anti-coagulant. (For notes on anti-coagulant *vide infra.*)

15. If the blood is not flowing freely the stream can be aided by the use of slight suction with the exhaust pump (one or two pumps each half minute), by the donor's slowly but firmly opening and clenching his hand, or by alteration in the position of the needle.

16. When the blood has been collected the manometer is deflated, the needle is withdrawn from the vein and a dry sterile pad is placed over the vein and held in place with a bandage. This can be removed in six hours and the wound left open to the air after the application of iodine.

17. The donor should lie down for at least fifteen minutes after giving blood, and should drink warm tea or coffee.

18. Should the donor feel faint at any stage, he can often be revived if his face is rubbed with a cold towel, if he is given a drink of cold water and if he receives plenty of encouragement. At least 90% of donors can give 600 cubic centimetres of blood without any discomfort so long as a rational technique is used. It must be stressed that in order to collect 600 cubic centimetres (one pint) of blood consistently from a series of donors without causing them any distress or without experiencing any interruption in the flow of blood into the flask, the operator must observe every detail. If he fails to do this the yield will inevitably be less and this will call for more work, more apparatus and more donors.

Anti-Coagulant and Preserving Fluid.—If the blood is to be administered within six hours of collection a simple citrate solution will be adequate. Two ounces (50 to 60 cubic centimetres) of 3·8% sodium citrate solution will prevent 600 to 800 cubic centimetres of blood from clotting so long as the blood is well shaken during the collection.

During the past year extensive research work has been carried out in an attempt to determine the best anti-coagulant and preservative fluid for use when the blood has to be stored. The fluids most favoured at the present time are that advocated by the Institute of Hæmatology and Blood Transfusion of Russia (referred to as the

"I.H.T." solution), the solution used by Jorda in the Spanish Civil War, and finally the antiseptic preservative solution advocated by Harrington and Miles.[10]

The "I.H.T." is as follows:

Sodium chloride, 7 grammes.
Sodium citrate, 5 grammes.
Potassium chloride, 0·2 gramme.
Magnesium sulphate, 0·04 gramme.
Aqua distillata ad 1,000 cubic centimetres.
Use with equal parts of blood.

The solution used by Jorda in Spain is as follows:

Glucose, 1%.
Sodium citrate solution, 4%.
Use one part of solution to nine parts of blood.

Harrington and Miles advocate the following solution:

Normal saline solution containing
Sodium citrate solution, 1·05%.
Glucose, 0·3%.
(Sulphanilamide, 0·15%, may be added to minimize the risk of infection.)
Use one part of solution to two parts of blood.

The relative merits of these preserving solutions are at present being investigated. Those advocated by Jorda and by Harrington and Miles appear to be most satisfactory.

Preserving solutions are best sterilized by filtration.

Storage.

Preparation of the Flask for Storage.—When the blood has been collected the rubber collecting tube is clamped close to the flask and the free end cut off close to the clamp. The blood in the tube can be run out into sterile tubes and used for typing, for the Wassermann test and possibly for culture. The flask of blood is clearly labelled (donor's name, blood group, date of collection, ease of collection and preserving fluid), placed in a refrigerator and maintained at a temperature range of 2° to 4° C.

Types of Refrigerator.—An electrically driven refrigerator is the most efficient because of its reliability and accurate regulation of temperature. The electric power can be drawn from the main source of supply or from an auxiliary or plant driven by petrol, kerosene or oil. Other sources of refrigeration are coal, gas, kerosene and ice blocks. Investigations are being made into the relative efficiency of these alternative methods.

The blood should be stored at a general hospital whenever possible. The refrigeration available there should be investigated, together with its temperature range and the possibility of obtaining another source of supply should the existing supply be temporarily or permanently cut off. The possibility of installing the alternative methods (kerosene, gas and ice blocks) at the hospital should be investigated; also, the other places in the town where refrigeration is available should be recorded. Refrigeration may be found at the pharmacist's, the butter works, the butcher's, the confectioner's, a dairy, the grocer's, hotels, larger private houses and ham and beef shops. The confectionery trade appears to be the least essential in times of national emergency, so that its plants may be commandeered with a minimum of inconvenience to essential services.

Inspection and Tests of Blood During Storage.—Various changes take place in blood during storage. The conclusions reached by workers in this field are of interest.

Filatov[9] (quoted by Vaughan[10]) states that during storage the following changes take place: The fragility gradually increases and is pronounced after the fifteenth day. Variation in shape and size of the cells appears after the fifteenth day and is soon followed by hæmolysis. The sugar content falls after the second day. The lactic acid content increases. The inorganic phosphorus content increases. The hæmoglobin becomes more stable. The albumin and globulin contents remain constant for at least fourteen days. The blood becomes more acid. After seven days only 50% of complement remains and after fourteen days it is absent.

The platelets begin to disappear on the first day, and have disappeared by the fifteenth day. Concerning the white cells, opinions vary. The agglutinability of the red cells gradually increases, and the sedimentation rate diminishes.

Harrington and Miles[11] reached the following conclusions:

> The main conclusions from the chemical study are as follows: (i) In order to prevent delayed formation of small clots the final concentration of citrate in the stored blood should be 0·35 per cent. (ii) The state of oxygenation makes little or no difference to the keeping qualities of blood; oxygen capacity has been well maintained in all samples. (iii) Dilution is highly advantageous in delaying hæmolysis. (iv) We can observe no improvement on addition of magnesium sulphate and potassium chloride to the anti-coagulant solution as in I.H.T., there is a suggestion that addition of glucose to 0·1 per cent. final concentration may delay hæmolysis somewhat, but we do not regard this point as securely established.
>
> Sulphanilamide may be added to the blood before storage. In concentrations of 0·05 per cent. it had no deleterious effect on the blood, and there was no diminution in sulphanilamide content, as estimated by the usual methods, over a period of fifteen days. Cocci added to stored sulphanilamide blood neither died nor multiplied in fifteen days at 2° C., but 1,000 per c.cm. were killed if the chilled blood was incubated for two days at 37° C.

Bick,[12] working at the Walter and Eliza Hall Institute of Research in Pathology and Medicine, made the following observations:

> The storage of human blood was accompanied by a decrease in the glucose content of the blood, an increase in the reduced glutathione, uric acid, creatinine, non-protein nitrogen and inorganic phosphate. There was little increase in the urea content of the blood.
>
> The onset of hæmolysis could be delayed by the addition of glucose. The optimum amount of glucose was 0·6 to 0·7 p.c. A small part only of the increase in non-protein nitrogen was accounted for by the increase in urea, creatinine and uric acid. Hæmolysis of the erythrocytes generally occurs when the non-protein nitrogen reaches a concentration of 55-60 mgm. per 100 c.c. blood.

Bick concluded that the biochemical changes that took place might be attributed to the erythrocytes, but the essential nature of the process was unknown.

In America, Kolmer[13] reached the following conclusions:

> (i) While sodium citrate is slightly anticomplementary, the complement of citrated (0·35%) human blood, kept at 4° to 6° C., was well preserved for periods up to 14 to 21 days. The same has been found true of undiluted citrated guinea-pig complement kept at 2° to 4° C.
>
> (ii) The bactericidal activity of normal citrated human blood kept at 4° to 6° C. For *S. aureus*, beta-hemolytic streptococcus and *B. coli* decreased after 7 to 21 days' preservation.
>
> (iii) The phagocytic activity of the neutrophils of preserved citrated human blood kept at 4° to 6° C. for *S. aureus*, beta-hemolytic streptococcus and *B. coli* was definitely reduced within 72 hours after collection of blood, becoming markedly so on or about the fifth day, followed by almost total absence of phagocytic activity on and after the seventh day of preservation. This may have been due to deterioration of normal opsonins but was mostly due to autolytic and degenerative changes in the leukocytes.
>
> (iv) The erythrocytes of preserved citrated human blood kept at 4° to 6° C. showed evidences of swelling and dehemoglobinization as early as 48 hours after collection with progressive degenerative changes up to 14 days, when at least 30% were shadows, swollen and fragile.

(v) The neutrophils of preserved citrated human blood kept at 4° to 6° C. showed evidences of disintegration with reduction in numbers as early as 24 hours after collection, with progressive disintegrative and autolytic changes up to 14 days (longer intervals of preservation not being employed).

(vi) The platelets of preserved citrated human blood kept at 4° to 6° C. showed distinct clumping immediately and 24 hours after collection with evidences of deterioration in the latter. At the end of 48 hours they became scarce and after 5 days only blue chromatin masses remained.

(vii) For reasons discussed it is believed that citrated human blood preserved at 4° to 6° C. may be useful in the treatment of acute hæmorrhage and shock for the purpose of restoration of volume, but it is inadvisable for the treatment of the anemias, the blood dyscrasias or infections, and certainly should not be employed for these purposes after 2 to 3 days' preservation.

Scudder[39] and his co-workers studied the shift of potassium from the red cells to the surrounding plasma during blood storage. They reached the following conclusions:

1. There is a daily increase in the plasma potassium of preserved blood kept under aseptic, bacteriostatic conditions, with increments reaching as high as 1,000 per cent.

2. None of the preservatives tested prevent this diffusion of potassium from the cells, the lowest rates being found in blood preserved in a mixture containing 0·3 gm. of sodium citrate per hundred cubic centimeters.

3. Agitation, such as shaking, hastens the loss of potassium from the cells.

4. The shape of the container markedly influences the rate of potassium diffusion; the greater the interface area between the cells and the supernatant plasma, the greater the rate of diffusion. This suggests that tubular containers may be preferable to wide-bottomed flasks.

5. There is no parallel between the rates of diffusion of potassium and hemoglobin; hence the degree of hemolysis cannot serve as an index of plasma potassium.

7. In pathologic states associated with potassium retention or sensitivity the use of blood preserved too long seems ill advised.

The appearance of hæmolysis is the most important limiting factor of blood storage. Commencing hæmolysis is shown by a faint haze of hæmoglobin above the layer of sedimented red cells. A narrow band of free hæmoglobin can probably be disregarded, especially in times of national emergency. When this becomes denser and diffuses higher into the plasma the blood becomes unsuitable for use.

Before this occurs the plasma should be carefully drawn off and stored at a temperature between 2° and 4° C. It may be stored in this way for several weeks, and serves as the most valuable fluid for intravenous infusion in cases of hæmorrhage and shock when blood is not available (*vide supra*).

Apart from being typed and subjected to the Wassermann test (*vide supra*), the blood should be tested for sterility. Organisms may gain access from the skin of the donor, the breath or hands of the operator, or from unsterile instruments, through contamination of the "antiseptics" employed (spirit is often contaminated), through contamination of the local anæsthetic, through contamination of the blood-collecting apparatus, through failure to keep the storage bottle sealed off from the outside air, and through contamination during the subsequent manipulations, especially if the blood is filtered, pooled and redistributed in other flasks either prior to or during storage.

Failure to maintain the blood at a low temperature also favours bacterial growth. It is suggested that attempts at culture of samples of the blood should be made both aerobically and anaerobically in meat medium and agar slopes at a temperature of 37° C.

It is generally accepted that with present methods the red cells usually begin to be hæmolysed after two weeks of storage, and this factor limits the length of time that blood can be kept. Storage is good for two weeks, moderately good for three weeks, and poor after the third week. Hæmolysis is hastened if the blood is shaken or heated above 4° C. Thus, whenever possible, any manipulation or shaking during transport should be carried out as soon as possible after collection. When the cells are less fragile, shaking during transport can be minimized by complete filling of the container. Jorda[20] has designed a two-chambered container connected by two fine tubes. One chamber is filled with blood and the other with air compressed to two atmospheres. The increased oxygen tension maintains the red cells in a state of over 90% oxygenation and the blood is bright red in colour instead of the usual dark red colour of blood stored at atmospheric pressure. The advantage of this method is that if bacterial contamination takes place the hæmoglobin is converted into hæmatoporphyrin and becomes dark red and later black in colour. This can be readily observed by simple inspection of the flask. Thus the margin of safety is greatly increased and during times of stress routine culture need not be made. However, this method is accompanied by many technical difficulties.

Bactericidal Agents.

Recently, Harrington and Miles[21] have suggested that sulphanilamide should be added to the diluting fluid to minimize the risk of infection (*vide supra*). They state:

> Bactericidal power has been tested by mixing graded inocula of a virulent Group A *Str. pyogenes* with 1-c.cm. samples of blood, the mixtures being held at 37° C., and tested at two hours, one, two, four and six days. Under these conditions no 1-c.cm. specimen of citrated blood was capable of killing streptococci in numbers as small as 5. But blood to which 0·05 to 0·06 per cent. sulphanilamide was added killed up to 500 cocci; bacteriostasis of inocula up to 5,000 was maintained for three days, after which free multiplication took place. Sulphanilamide conferred this degree of killing power on bloods stored for periods up to twenty-six days.

Filtration.

It is generally agreed that clots tend to form in stored blood. Jorda states that the blood should be filtered soon after collection. Others consider that it is necessary to filter the blood only during administration to the recipient. Extensive dilution of the blood, as when the "I.H.T." technique is used (equal parts of solution and blood), greatly favours the second opinion, as the blood is rendered far less viscid.

Every effort should be made to reduce the number of procedures which are applied to the blood, as this prolongs the life of the corpuscles and is a saving in labour and apparatus.

Transport.

Transport of blood should be reduced to a minimum, as it occupies valuable space in rolling stock or aeroplanes. Moreover, it requires special equipment for the maintenance of a low temperature and possibly special flasks for carrying the blood. Finally, shaking of the blood tends to hasten hæmolysis of the red cells. Transport can be minimized if there are multiple depots of stored blood. Possibly a mobile blood collecting unit could visit the various outlying centres in rotation and store the blood locally. This would reduce not only the transport of blood, but also transport of the donors (*vide supra*).

Flasks for Transporting Blood.—If the special one-litre blood collecting flasks are used, they can be completely filled with blood and a preserving fluid such as "I.H.T." (500 cubic centimetres of blood and 500 cubic centimetres of "I.H.T.") and then covered with a special metal protector.

If a milk bottle is employed the original bottle used for the collection can be used; or else the blood can be filtered into a second one-pint bottle, which is completely filled and capped with a rubber cork, not perforated. A second cork pierced by two glass or metal tubes, one long and one short, is supplied separately, and is inserted in place of the first cork immediately prior to administration of the blood. This avoids the need for having a glass or metal tube in contact with the blood during storage. This is an advantage, as blood clots tend to form around the tube (Vaughan, personal communication). A blood delivery tube is supplied with the extra cork.

Rules for Transport.—The following rules, if carried out, mean good transport of the blood:

1. Transport the blood in flasks completely filled with blood (no air lock above the blood). This minimizes shaking of the blood and so reduces hæmolysis.

2. Transport the blood as soon as possible after it is collected, as the fragility of the corpuscles increases with time of storage.

3. Maintain a temperature between 2° and 4° C. The red cells are hæmolysed if the blood freezes. Any rise in temperature above 4° C. or perhaps 7° C. tends to hasten hæmolysis.

4. Minimize shaking by using well-sprung vehicles, good roads and specially packed blood containers. Air transport will probably be preferable to road transport in this respect.

The following available means of transport may be used: (i) a specially constructed ambulance, as used in Spain by Jorda; (ii) other motor vehicles in civil use which have been constructed with cooling devices, such as ice carts and ice-cream carts; (iii) motor or horse-drawn vehicles without any refrigeration, as used in civil or military life; (iv) trains with or without refrigeration; (v) aeroplanes with or without refrigeration.

Refrigeration During Transport.

1. Electrical refrigeration. The current is generated by a special motor driven by petrol, kerosene or oil. Some units at present in use in civil life are run by electricity from the main supply when the vehicle is at the base or stationed at any place where current is available. Jorda's ambulance had storage batteries charged by a motor driven by petrol. It may be possible to have a mobile "storage box" on wheels, consisting of refrigerator and motor. This storage box could be wheeled into a standard ambulance, truck or railway carriage. It could be easily pushed about by hand.

2. Ice chests. Ice chests with ice blocks or special chemical freezing mixtures may be used.

3. Well insulated boxes or tins. In Spain Jorda used "isothermic cases containing a refrigeration mixture" when the special vehicles were not available.

4. Air. During air transport at high altitudes low temperatures could easily be maintained. The danger of freezing would have to be considered.

The following quotation from *The British Medical Journal*[(38)] is of great interest:

> Owing to the speed of modern transport it is possible to collect blood for transfusion purposes in a relatively peaceful area and send it to points on a fighting front where it is most required. With this in view the authorities have in mind to organize a blood-collecting depot in Bristol for the supply of blood to the fighting forces. The depot will be situated at Southmead Hospital, where facilities have been granted by Dr. R. H. Parry, medical officer of health for Bristol. The organization of this depot is already under way, and it is hoped within the next few months to obtain and to group 10,000 volunteers from among the women employees of the big commercial firms in Bristol. The managers of the firms who have been approached have offered every facility. In time of war subsidiary blood collecting centres would be established in the big towns of the west of England, so that the number of donors could be increased to 100,000. The central depot at Southmead Hospital would be for the collection and storage of blood in specially designed pint bottles. The proximity of Filton Aerodrome would allow the blood rapidly to be flown to its destination.

Administration of Blood.

The blood is administered from the blood reservoir through a length of gum rubber tubing, in which is included a blood filter and usually a dropper to show the rate of flow. Gravity pressure is most commonly employed. The vein can be entered with the aid of special apparatus or by being exposed with an incision. The details of administration will be submitted for publication in the near future.

The special apparatus for entering the vein may be either (i) a three-way tap, as used by Jorda,[(39)] or (ii) a Kauffman syringe.

The following are the rules for exposing the vein and inserting the needle or cannula:

1. Gently apply a tourniquet of soft rubber tubing to the upper part of the arm.
2. Make a longitudinal scratch on the skin along the line of the vein, three-quarters of an inch in length.
3. Infiltrate the scratch with local anæsthetic (a 2% solution of "Novocain", "Pantocain" or "Ethocain").
4. Make an incision three-quarters of an inch in length along the line of the scratch.
5. Tear aside the subcutaneous tissues by inserting fine Spencer-Wells forceps into the wound and opening them. This will be aided by elevation of the far edge of the wound with dissecting forceps.
6. When the upper surface of the vein is exposed it can be hooked out by Spencer-Wells forceps slipped underneath it.
7. Open the forceps so that the vein lies across the blades.
8. Make a snick in the wall of the vein and insert the cannula or needle.
9. If necessary, tie in the cannula or needle.

With practice the operator may expose the vein and insert the cannula or needle within three minutes. This is often far easier and more reliable than attempting to puncture the vein through the skin. The cannula or needle can be fixed in position with strapping and the patient left till the blood has all run in. If the gravity method is used it does not matter if all the blood leaves the flask. The venous pressure will prevent air from entering the vein.

Cleaning and Preparing Apparatus.—It is essential that all the glassware and rubber tubing should be thoroughly cleaned prior to sterilization. This greatly minimizes the risk of transfusion reactions. This work would be the duty of the staff of the blood storage unit.

Preparation of the Preserving Fluid.—Every precaution should be taken to ensure that the preserving fluid is free from bacterial or chemical contamination. The purest form of the chemicals used should be selected. Stores of these should be available for use in the event of a national emergency.

Summary.

1. The value of blood transfusion is briefly discussed.
2. The advantages and limitations of stored blood for transfusion are referred to.
3. A scheme for blood storage in time of national emergency is described.

Conclusions.

1. Blood can be collected from a donor, stored at 2° to 4° C., transported and administered with benefit to a recipient after an interval of nineteen to twenty-one days.
2. A scheme for blood storage would save many lives in times of national emergency.

Acknowledgements.

This paper is but a summary of the many ideas submitted to me by the Director and staff of the Walter and Eliza

Hall Institute of Research, by the honorary medical staff of the Royal Melbourne Hospital, and by the many workers both in Australia and abroad who have so generously helped us. I am deeply indebted to my co-workers, Miss F. Williams and Miss M. Bick.

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References.

(1) J. A. Kolmer: "Preserved Citrated Blood Banks", *The American Journal of the Medical Sciences*, April, 1939, page 442.
(2) Medical Research Council of the Privy Council, Special Report Series, Number 25, 1919.
(3) F. D. Jorda: "The Barcelona Blood Transfusion Service", *The Lancet*, April 1, 1939, page 773.
(4) G. A. Elliott, R. G. Macfarlane, J. M. Vaughan: "The Use of Stored Blood for Transfusion", *The Lancet*, February 18, 1939, page 384.
(5) A. N. Filatov: "The Advantages and Disadvantages of Preserved Blood for Transfusions", *Vestnik khirurgii*, Volume LI, 1937, page 194. (Quoted by Vaughan.(6))
(6) G. Keynes: "Blood Transfusion", 1922, page 1.
(7) B. Fantus: "Therapy of Cook County Hospital: Blood Preservation", *The Journal of the American Medical Association*, Volume CIX, July 10, 1937, page 128.
(8) S. S. Yudin: "Transfusion of Stored Cadaver Blood', *The Lancet*, Volume II, 1937, page 361.
(9) J. Vaughan: "Blood Transfusion", *The Lancet*, Volume I, May 6, 1939, page 933.
(10) "Stored Blood", *The British Medical Journal*, Volume I, June 10, 1939, page 1187.
(11) E. W. Flosdorf and S. Mudd: "Procedure and Apparatus for Preservation in 'Lyophile' Form of Serum and other Biological Substances", *The Journal of Immunology*, Volume XXIX, 1935, page 389.
(12) H. J. Gardiner: "Determination of Blood Compatibility before Blood Transfusion and Avoidance of Subsequent Reactions", THE MEDICAL JOURNAL OF AUSTRALIA, Volume II, December, 1936, page 839.
(13) C. K. Harrington and A. A. Miles: "Storage of Blood for Emergency", *The British Medical Journal*, Volume I, June 10, 1939, page 1202.
(14) M. Bick: "The Biochemical Changes Occurring during the Storage of Human Blood", *The Australian Journal of Experimental Biology and Medical Science* (in the press).
(15) J. Scudder, C. Drew, D. Corcoran and D. C. Bull: "Studies in Blood Preservation", *The Journal of the American Medical Association*, Volume CXII, Number 22, 1939, page 2263.
(16) "Blood for the Fighting Services", *The British Medical Journal*, Volume I, June 17, 1939, page 1238.

Medical Societies.

THE MELBOURNE PÆDIATRIC SOCIETY.

A MEETING of the Melbourne Pædiatric Society was held at the Children's Hospital, Carlton, Melbourne, on September 13, 1939, DR. D. O. BROWN, the President, in the chair.

Erythrœdema or Pink Disease.

DR. GORDON FORSYTH read a paper entitled "Pink Disease Treated by Vitamin B_1" (see page 751).

DR. HOWARD WILLIAMS then reviewed a series of eighty consecutive cases of erythrœdema admitted to the Children's Hospital over a five-year period ended June, 1939, with special reference to the causes of death and the complications.

Dr. Williams said that twenty deaths had occurred in the series, the mortality rate being 25%. The morbid anatomy accounting for the deaths was analysed under the following headings: bronchopneumonia, thirteen cases (16·2%); enterocolitis, four cases (5%); pyelonephritis, one case (1·3%); no adequate pathological change determined in two cases (2·5%). Dr. Williams added that in several instances enterocolitis was accompanied by bronchopneumonia not sufficiently extensive to be classified as the prime cause of death. He also said that the two children who had died without any satisfactory explanation being revealed at autopsy, had both collapsed suddenly and unexpectedly; histological examination of the medulla and brain-stem had been carried out in one of these cases, but no abnormal features had been detected.

Dr. Williams then proceeded to analyse the relationship between the general condition of the patients on admission to hospital and the causes of death. Of those whose general condition had been good on admission to hospital, nine children had died, one of them suddenly, one from enterocolitis and the remainder from bronchopneumonia. Of those whose general condition was poor on admission to hospital, eleven had died, one suddenly, three from enterocolitis, one from pyelonephritis and the remainder from bronchopneumonia. Of the latter group several had already contracted pneumonia at the time of admission to hospital; but it was evident that several, in good condition at the time of admission to hospital, had contracted secondary infections leading to death.

Dr. Williams then spoke of the complications, particularly those of an infective nature, which were very apt to develop in infants afflicted with erythrœdema. Fifty-one of the patients had developed complications which he had classified into three groups according to the predominant complication. Forty-five in the series of 80 children had shown evidences of infective complications; two others had become anæmic; and four he classified as suffering from malnutrition as a complication. Many of those with infections were considerably under-nourished, and several of the patients had developed more than one infection. In only two instances was there any degree of severity of anæmia; but fourteen of the patients were undoubtedly subjects of malnutrition. Dr. Williams stated that a further analysis of the infections revealed the high incidence of infections of the respiratory tract and the bowel. He classified them as follows: bronchopneumonia, 32%; bronchitis, 7%; *otitis media*, 8%; enterocolitis, 14%; pyelitis, 6%; skin infections, 10%; and stomatitis, 6%.

Dr. Williams remarked that it was evident that cross-infection was a factor of importance in the high incidence of infective complications. The cross-infection was not preventible when babies were nursed in the existing system of wards. Unless there was a very valid reason, babies suffering from erythrœdema should not be admitted to a large hospital, but every attempt should be made to have them nursed at home. Two other interesting facts had emerged from the analysis of the cases; they were the long duration of symptoms prior to admission to hospital and the long stay in hospital. The average duration of symptoms before admission to hospital was eight weeks, but the periods varied up to seven months. The average period of time spent in hospital was six weeks.

With reference to the symptomatology, Dr. Williams said that almost invariably the predominant feature was irritability or misery. Frequently that symptom was present for weeks or months before the advent of symptoms such as sweating, hypotonia and pinkness of the extremities. Abdominal colic and constipation were frequent features, and as presenting symptoms were notably misleading.

From his study of the cases Dr. Williams considered that certain points of significance were established. Erythrœdema was an illness usually extending over a period of several months. The affected infant had frequently been ill for months prior to admission to hospital. Improvement following the institution of any treatment might be due to spontaneous recovery on the part of the patient or to a response to the treatment. In the absence of an accurate criterion of improvement, deductions as to the value of any therapeutic measure might be fallacious. Finally, Dr. Williams said that complications of an infective nature were very common amongst infants admitted to the hospital and had contributed largely to the high mortality rate of 25% in the series of cases he had analysed.

DR. H. BOYD GRAHAM thanked Dr. Forsyth for the interesting communication he had made to the Society. He also emphasised the fact that the statistical report by Dr. Howard Williams was further evidence of the inadvisability of treating patients with pink disease in

hospital wards. Of 80 patients in the series, two-thirds had had complications and one-quarter had died. The usually accepted mortality rate was 10%. It should not be overlooked, however, that many of the patients had been admitted to hospital only because of the severe nature of the illness, and the 25% mortality rate could not in fairness be quoted as the mortality rate of an unselected series of patients with pink disease.

Dr. Graham then referred to the difficulty of carrying out clinical research work in private practice. It was difficult especially for one observer to have the opportunity to study sufficient cases thoroughly enough to get a full view of the problems of the subject from all the necessary angles. He instanced Dr. Forsyth and his work on the role of vitamin *B* in pink disease, and the common factor, if any, in pink disease and pellagra or beriberi. He pointed out the limited applicability of the evidence in attempts to generalize and the danger of arguing by analogy. In a more general way there was an inherent difficulty in attempting to solve the riddle of the etiological factors in pink disease by the results obtained by therapy. Pink disease followed a course of indefinite but limited duration, tending towards recovery, with few exceptions, unless certain accidents happened, such as intercurrent infection. Dr. Graham stated that the test substance in therapy could not be adequately controlled, as so many other possible factors were operating during the currency of the test.

Dr. Graham said that it would be remembered that as early as 1920 in the United States of America, Bilderback had drawn attention to what Swift had called "erythrœdema", and shortly afterwards, in the same year, Byfield had shown a patient at a medical meeting under the caption "polyneuritis resembling pellagra". Again, in 1920, Weston had called the condition "acrodynia", and in 1921 and 1922 odd examples were identified in England, such as the one recognized in March, 1922, by Thursfield and Paterson because of the similarity to the "chronic mutilating acrodermatitis" of Parkes Weber and to Byfield's case resembling pellagra; that resemblance had frequently been noted. Dr. Graham quoted as an example of pellagra a recent instance in the case reported in THE MEDICAL JOURNAL OF AUSTRALIA of September 4, 1937, at page 413, by Dr. Edgar Stephen, of Sydney. Dr. Graham was in agreement with that diagnosis on the evidence, though Dr. Stephen had not burnt his boats altogether. It could be stated, therefore, that Dr. Forsyth was in good company when he asked them again to compare pink disease with pellagra. The impression was given, however, that Dr. Forsyth wanted to push the analogy too far, particularly when the association between real pellagra and vitamin B_2 or even the vitamin *B* complex was reviewed. Dr. Graham went on to say that it was not generally accepted that pellagra was due to vitamin *B* deficiency alone. The other factors were a diet low in animal protein, an excess of maize in the diet and probably the pathogenicity of certain spore-bearers, such as *Penicillium* and *Aspergillus* of Georgi and Beyer. Recently, Trowell, in *Archives of Disease in Childhood*, Volume XII, August, 1937, had drawn attention to points of similarity between mild infantile pellagra and pink disease, and the beneficial effects in the treatment of pellagra in African children with massive amounts of "Marmite" (yeast product) and liver; but he had added that maize had had to be eliminated from the dietary and the animal protein content of the diet had had to be increased considerably.

Dr. Graham asserted that pellagra, therefore, was not a straight-out vitamin deficiency disease. "Marmite", yeast products, other sources of antineuritic vitamin *B* and liver treatment in various forms had become commonly used in pink disease in the absence of a reliable specific; but too much should not be claimed for them. He had been impressed by the experimental work on rats which had been conducted in 1928 by Marshall Findlay and Ruby Stern, reported in *Archives of Disease in Childhood*, Volume IV, Number 19, February, 1929, at page 1, and had continued to advocate the inclusion of fresh liver, liver juice, fresh raw egg white and potato juice in the diet of patients suffering from pink disease, in the hope that in some empirical way a requisite would be satisfied thereby; but that action on his part had never been dramatic in its effect on the progress of the illness.

Dr. Graham pointed out that the danger of arguing from analogy might be illustrated well by mention of certain conditions other than pellagra which showed just as many points of resemblance to pink disease as did pellagra. He indicated that polyneuritis was a main symptom of subacute and chronic arsenical poisoning, which also caused a rash on the body at times, moderate pyrexia and gastro-intestinal disturbances, and waxed and waned with dietary changes according to the intensity of spraying of the included or excluded fruits and vegetables with arsenical spraying solutions.

About ten years before, Petron, of Sweden, had raised the possibility of arsenic being the cause of infantile acrodynia of the Selter-Swift-Feer type. Petron's ideas had been borne out by investigation of the spraying of the vegetables which had been consumed by the victims of the outbreak in northern Europe from 1928 to 1930. In 1933 Mayer and Weise, and again in 1935 Calvin and Taylor had raised the same question in the United States of America, and arsenic in excess had been recovered from the hair, blood and urine of the patients. Dr. Graham stated that those findings were not constant in pink disease, and none of the members of the Melbourne Pædiatric Society believed that arsenic was the cause of pink disease.

Dr. Graham had been greatly interested in the literature of the pathogenicity of certain cereal rusts and smuts for human subjects, and the resemblances of the syndromes to pink disease. He had obtained a number of original articles on the subject from Europe since his attention had been drawn to the points of interest in the excellent monograph on the epidemiology and pathogenesis of infantile acrodynia published by Péhu, of Lyon, and Boucomont, of Montpellier, in 1936.

Dr. Graham then mentioned that the incidence of ergotism in rye-eating communities was well recognized as a serious condition, and types such as the convulsive type and the gangrenous type were distinguished. The features were: (i) elevation of blood pressure, tachycardia and the effect on the heart musculature; (ii) the intolerable itching of the arms and legs and the mucous surfaces of the mouth and nose, severe peeling of palms and soles and liability to early dry peripheral gangrene, especially of the finger tips, with residual pigmentation in the skin areas affected; (iii) spasmophilic features, such as cramp, twitchings, convulsions, contractures and latent tetany; (iv) intense thirst, loss of appetite, loss of weight, muscular weakness and attacks of colic and pain; and (v) psychic phenomena, such as excitability, delirium and mania.

Dr. Graham went on to say that ergotism was largely due to ingestion of rye flour infested with the *Claviceps purpurea* of the parasitic *Secale cornutum*, which was an ascomycetic fungus of the Eumycetes class of the Thallophyta. It was of more than passing interest to note that the Aspergillaceæ under investigation in connexion with pellagra were also Ascomycetes of the same class, which incidentally also included the yeast fungi (Saccharomyces). A further point of interest was that the other subclass of Eumycetes—the basidiophores—included the cereal rusts and smuts, of which the maize smut producer, *Ustilago maïdis*, might be regarded as a good example. It was a parasite which ramified in the stem and reached the inflorescences of the growing maize plant. The mycelium was transformed into a dark brown or black mass of spores, which were scattered by the wind and after a rest period germinated and produced further basidia in the following season, thus infecting the young crop of maize.

Dr. Graham said that he wished to give a brief description of the condition described by Mayerhofer as due to the pathogenicity of the *Ustilago maïdis*—the maize smut. The term "ustilaginism" was a useful name to apply to it. It was less severe than ergotism, and resembled erythrœdema in many respects, which included the fact that the age period attacked most commonly and most severely was that of infancy and early childhood. The features were: (i) extreme irritability of the extremities, especially the hands and feet, with redness, swelling and

itching of the mucous membranes of the nose and mouth; (ii) intense dry scaling and true peeling of the palms and soles, with very little sweating; (iii) fever at the onset and irregularly during the course of the acute symptoms; (iv) muscular weakness preceded by rheumatic-like pains resembling mild ergot "cramp"; (v) redness, swelling and heat of the toes and fingers, and, later, pigmentation of those parts or dry gangrene; (vi) intense thirst and lack of appetite alternating with extreme hunger; (vii) gastro-enteritis and repeated attacks of colic; (viii) latent or manifest spasmophilia, eclamptic attacks, katatonic convulsions and contractures; (ix) irritability of the nervous system to the point of delirium or even mania; (x) high blood pressure persisting after apparent cure associated with tachycardia (bradycardia might be noted at the onset). An opium derivative (papaverine) was the antidote, and rapid cure followed the removal of smutty maize from the diet. Most severe syndromes and even death occurred if smutty maize feeding was continued, and allergic phenomena were observed if even a little smutty maize was reintroduced after quite a long interval. Exposure to sunlight or ultra-violet light produced acute exacerbation of symptoms.

Dr. Graham went on to say that Dragasic and Varicak had conducted animal experimental work of great interest with dilutions of the maize smut (4% to 5% in polenta). They had produced in mice an acrodynic syndrome. It was thus necessary to distinguish carefully between the pathogenicity of smut-infected maize producing ustilaginism, and the harmfulness of a diet in which maize was in excess (the factor in pellagra), and also to remember that the proof was not direct—the acrodynia did not arise spontaneously but was induced by a diet containing an adulterated substance, the parasitic substance.

Mayerhofer and Dragasic had themselves made it quite clear that they knew Selter-Swift-Feer disease and that it occurred too in Yugoslavia. They differentiated clearly between the two conditions and did not suggest that they overlapped, nor should they be confused with each other. Dr. Graham realized nevertheless that it was very attractive to theorize on the possibility of some such cereal parasite as the *Ustilago maidis* being a factor at work in the ætiology of pink disease. Babies got more than their fair share of barley, for instance, and many of them had it as a milk diluent, as a broth thickening or as a thickened milk feeding at the common age period for pink disease to be manifested.

Dr. Graham went on to speak of the interrelationship between vitamins, endocrinal hormones and the vegetative nervous system. He described the experimental work of Fleischmann and Kahn, published in 1936. They had taken two sets of sturdy mice and fed them all on a diet of oats; to one half (group A) they had given vitamin *A* also, and to the other half (group B) olive oil had been given instead. After a while each group was divided into two halves; into one half thyroxine was injected, and the remaining half in each case acted as a control subgroup. Then a usually fatal dose of methyl cyanide (acetonitril) was given to each of the mice in all four groups. The A1 group of mice (receiving vitamin *A* and thyroxine) had three survivors out of 16 mice (81% died); the A2 group (receiving vitamin *A* but not thyroxine) all died (100%). Of the B1 group (not receiving vitamin *A*, but receiving thyroxine) 18 survived out of 19 mice (16% died); and the B2 group (not receiving either vitamin *A* or thyroxine) all died (100%).

The deduction was that thyroxine protected the mice against an otherwise lethal dose of the cyanide, but that protection was counteracted by vitamin *A*.

There could be no doubt that an antagonism existed between hormones and vitamins, and it had been demonstrated that thyroxine and vitamin *A* were antagonistic. Dr. Graham wondered whether it could be shown similarly that adrenaline and the vitamin *B* group were antagonistic. Perhaps again parathyreoid extract and vitamin *D* might be opponents.

Dr. Graham drew attention also to the pigmentation in pellagra, ergotism and ustilaginism as a point of differentiation from pink disease, and the fact that pigmentation could be correlated with coproporphyrinuria, which had not been noted to occur in pink disease. Increased production of porphyrins was a nicotinic acid effect with mounting up of the blood and urine porphyrin content. Dr. Graham said that the point of very great interest in the conditions he had discussed was the common factor of raised blood pressure with tachycardia and the effects ascribable to interference with the functions of the subthalamic nuclei controlling the organic functions which were most important to the harmony of the human body, in the words of Péhu and Boucomont. These functions were: water metabolism, lipoid metabolism, protein metabolism, arterial pressure, vasomotor tonus, cell content of the blood, body temperature, secretion of sweat and the control of the sleeping state. It was also apparent that the peripheral connexions as well as the central nuclei were interfered with in pink disease as in the other conditions.

A neurotropic factor was at work, which might be a virus, thus confirming the frequently expressed opinion of Dr. Southby in the Melbourne Pædiatric Society. Dr. Graham did not feel that he could still maintain the view he had expressed on previous occasions, that the disease was due only to a deficiency of an unknown vitamin similar to those of the vitamin *B* group. In the light of present knowledge the most reasonable treatment was directed towards the correction of abnormal action of the nervous system. Dr. Bruton Sweet, of New Zealand, had reported in THE MEDICAL JOURNAL OF AUSTRALIA, Volume I, 1936, at page 430, the very successful results of treatment in 36 consecutive cases with ultra-violet irradiation without special diet or internal or external medication. The use of substances acting on the vegetative nervous system was complicated by the "chemical mediator" substances, and the tangle was very difficult to unravel. Dr. Graham had been interested in the effects of phenobarbital, bellafoline and ergotamine tartrate in combination; but the practical results could not yet be assessed with confidence. In conclusion, Dr. Graham paid a tribute to the faithfulness with which Dr. Forsyth had verified and studied the literature he had been able to obtain, and hoped that in some way further light would soon be thrown on the very interesting subject under discussion.

DR. IAN WOOD said that it was a great pity that they could produce so little real evidence from the hospital bearing on the cause of pink disease. He was afraid that he had to admit that he had no idea of the cause, though he still hankered after the infection theory. The attempts that he and his fellow workers had made to prove the infection theory had failed; but that did not disprove the theory. Anorexia led secondarily to avitaminosis, and a response to vitamin therapy therefore was not necessarily related directly to the cause of the disease.

DR. ROBERT SOUTHBY, after thanking Dr. Forsyth for introducing the subject under discussion, said that as Dr. Graham had mentioned it, he would like to support the ætiological theory of infection by a virus. He had noticed that young babies early in the illness suddenly manifested coryzal symptoms and conjunctivitis. In one instance that he recalled vividly, the baby was breast-fed and the mother had a similar coryzal attack a week before that of the baby; the baby proceeded to develop characteristic pink disease. Another factor indicative of the infective ætiology was that Dr. Southby had noticed that several practitioners in a group practising in one area might each see four, five or six cases of pink disease annually, many more than were seen by another group practising in a neighbouring district. As Dr. Graham had stressed very convincingly the danger of arguing by analogy, there might be a trap in comparing poliomyelitis and other known virus diseases with pink disease, so he hesitated to use that argument.

DR. KATE CAMPBELL thanked the previous speakers for the wealth of information their contributions contained. From her experience in working among them she was satisfied that many pregnant women showed evidences of deficiency of vitamin *B*. She had noted severe vomiting with peripheral nueritis and wasting of the small muscles,

and even the fully developed Korsakoff's syndrome. The feature of interest to Dr. Campbell was that the babies of women who had shown those evidences did not get pink disease as a rule, and that babies who suffered from the condition usually did so in the period in which mixed feeding was introduced and not in the earlier months of life.

DR. W. W. McLAREN said that he had been amazed at the extent of research into literature which had been displayed by Dr. Forsyth and Dr. Boyd Graham. Nevertheless the main point was that at the hospital over a period of five years the mortality rate in pink disease had been 25%. He added that many of the complications and deaths could have been avoided if the directions laid down by the late Dr. A. J. Wood in THE MEDICAL JOURNAL OF AUSTRALIA in February, 1921, had been followed, and also by insistence on the importance of keeping babies with pink disease out of hospital.

DR. H. DOUGLAS STEPHENS also thanked Dr. Forsyth for the way in which he had put the case for the vitamin *B* complex. Dr. Stephens had seen the disease for many years; indeed from the very early days. He recalled asking the late Sir Charles Clubbe, of Sydney, whether it was pellagra or early pellagra, and Sir Charles Clubbe had replied that he recognized the condition and for want of a better name had called it "pink disease". Dr. Stephens added that he understood that Sir Charles Clubbe was the first to use that name for it.

Dr. Stephens remarked that some of the patients recovered quickly and others needed treatment for more than six months, whatever treatment he had used. He could remember when "Salvarsan" and many other arsenical compounds had been used for it. In the light of what they had heard that night, the arsenical treatment was probably the worst form of treatment. Yeast had also been used; but it could be inferred from what Dr. Graham had said that that too might be unwise. Dr. Stephens had had cases in which the teeth fell out and the nails came off; in one such instance he had given antistreptococcal serum and in ten days the child was well again. He wondered whether anyone had exploited "M & B 693" therapy; he had used it in one case and the child had promptly vomited.

DR. M. KENT HUGHES asked whether there was any evidence that "Bemax" contained vitamin B_1. He said that it was toasted, presumably to stop the oil in it from going rancid. The manufacturer of a similar preparation avoided exceeding a temperature of 120° F. in order to save the vitamin B_1 content from destruction.

Dr. Forsyth, in reply, expressed his appreciation of the way in which his address had been received, and said that he had tried to provoke a discussion and had succeeded. He had had eleven cases and no deaths, and he believed that the Children's Hospital got the worst type of case. The heavy incidence of complications and deaths in the series analysed by Dr. Williams could be accounted for along those lines. It was all very well to say that the children should not be put into hospital; but frequently it was not at all possible to have them treated properly in their own homes. Dr. Forsyth challenged Dr. Graham's statement that pellagra was not due solely to a vitamin deficiency. He had been at great pains to get the most reliable and the latest information on that point. Nicotinic acid was specific for pellagra, though the polyneuritic element had to be treated with vitamin B_1. Dr. Forsyth agreed about the probability of antagonism between adrenaline and vitamin B_1; according to pharmacologists they were antagonistic.

In reply to Dr. Kent Hughes, Dr. Forsyth said that vitamin B_1 was not destroyed by dry heat, but by moist heat in an alkaline medium. He had no definite information about "Bemax" beyond the claims of the manufacturers that it was a potent source of vitamin B_1.

DR. D. O. BROWN, from the chair, expressed the thanks of the members of the Society to Dr. Forsyth. He said that when it was remembered that he was limited to practice in a country district, the address that he had given them that evening and the enthusiasm which had prompted it and his visit to the meeting were deserving of the highest praise.

(To be continued.)

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 121, of November 2, 1939.

PERMANENT NAVAL FORCES OF THE COMMONWEALTH (SEA-GOING FORCES).

Appointment.—The following officer of the Emergency List is reappointed for temporary service: *Surgeon Commander*—James Mann Henderson.

Extension of Appointment.—The appointment of Surgeon Lieutenant Frank Frederick Coffey is extended for a period of two years from 12th January, 1940.

Emergency List.

Resignation.—The resignation of Clifford Henry of his appointment as Surgeon Lieutenant is accepted, dated 20th September, 1939.

THE SECOND AUSTRALIAN IMPERIAL FORCE.

6th Division and Ancillary Troops.

To be Colonel.—Colonel S. R. Burston, C.B.E., D.S.O., V.D., Australian Army Medical Corps, 4th Military District, and to be Assistant Director of Medical Services.

AUSTRALIAN MILITARY FORCES.

First Military District.

Australian Army Medical Corps.

To be Captain (provisionally)—Reginald Maltby, 11th September, 1939. *To be Captain (provisionally) supernumerary to establishment pending absorption*—Godfrey James Byrne, 11th September, 1939; Captains (provisionally) M. J. Hishon and R. Perkins are transferred to the Reserve of Officers (A.A.M.C.) and to be Honorary Captains, 29th September, 1939.

Australian Army Medical Corps Reserve.

To be Honorary Major—Sidney Firth Lumb, 21st September, 1939. *To be Honorary Captains*—Edward Allan Fancourt McDonald, Derick McRae Yeates, Sylvester Edwin Warriner and Charles Eugene Thelander, 25th September, 1939.

Second Military District.

Australian Army Medical Corps.

To be Captain (provisionally)—Reginald Errol Maffey, 18th September, 1939. Lieutenant-Colonel K. P. Rutherford relinquishes the command of the 14th Field Ambulance and is placed upon the Retired List with permission to retain his rank and wear the prescribed uniform, 23rd September, 1939.

Captain P. F. Murphy ceases to be seconded, 1st September, 1939.

Australian Army Medical Corps Reserve.

To be Honorary Lieutenants—Kenneth Bruce Chisholm and Robert Waterford Wright, 8th September, 1939, and 21st September, 1939, respectively.

Third Military District.

Australian Army Medical Corps.

To be Captain (provisionally) supernumerary to establishment pending absorption—John Ochiltree Lavarack,

18th September, 1939; the provisional appointments of Captains H. I. Gibb, M. M. Rosefield and C. H. Johnston are confirmed; Captain W. G. G. Sinclair is brought on the authorized establishment, 1st July, 1939; Captains (provisionally) J. G. Johnson, J. M. Agar, A. D. Mawson and J. G. Loughran are brought on the authorized establishment, 1st September, 1939.

Captain G. J. B. Baldwin is appointed from the Reserve of Officers (A.A.M.C.), 24th August, 1939.

Australian Army Medical Corps Reserve.

To be Honorary Captain—Arthur Robert Haywood, 1st September, 1939.

Fourth Military District.

Australian Army Medical Corps.

To be Captains (provisionally) supernumerary to establishment pending absorption—John David Rice, 22nd September, 1939; Carl Clifford Jungfer, 27th September, 1939; and Robert Stuart Wilkinson, 28th September, 1939. The provisional appointments of Captains S. L. Seymour, E. P. Cherry, R. C. Angove, W. M. Irwin and M. C. Newland are confirmed.

Australian Army Medical Corps Reserve.

To be Honorary Captains—Alan Thomas Harbison, Kenneth Francis Cooper and Gavin Viner Smith, 22nd September, 1939; Alan Frank Hobbs, 25th September, 1939; Thomas Wilson Tassie, Henry Gordon Prest, Laurence Algernon Wilson and Robert Welch Gibson, 28th September, 1939. *To be Honorary Lieutenants*—Alexander Robert Wotton, 22nd September, 1939; Lorenz Wilfrid Jungfer and Herbert Friederich Sudholz, 25th September, 1939; Leslie Charles Gabell and George Frederick Patfull, 28th September, 1939.

To be Honorary Lieutenant—Robert Douglas Hughes, 14th October, 1939.

Sixth Military District.

Australian Army Medical Corps.

Honorary Captain J. F. Connell is appointed from the Reserve of Officers (A.A.M.C.) and to be Captain (provisionally), supernumerary to establishment pending absorption, 27th September, 1939; Captain J. S. T. Stevens is transferred from the Australian Army Medical Corps, 3rd Military District, and is supernumerary to establishment pending absorption, 26th September, 1939.

Seventh Military District.

Australian Army Medical Corps.

To be Captain (provisionally)—Alexander Joseph May, 26th September, 1939.

Royal Australian Air Force.

Citizen Air Force (Active Force).

Medical Branch.

John Aloysius O'Brien, M.B., Ch.B., F.R.A.C.S., is granted a commission as Squadron Leader with the honorary rank of Wing Commander, 1st October, 1939. The following are granted commissions as Flight Lieutenants with the honorary rank of Squadron Leader, with effect from 1st October, 1939: Ian Gideon McLean, M.D., B.S., M.R.C.P. (London), F.R.A.C.P.; Leonard Bell Cox, M.D., B.S., M.R.C.P. (Edin.); Conrad George Howell Blakemore, M.B., Ch.M., D.O.M.S. (London), F.R.C.S. (Edin.), F.R.A.C.S.; Hamilton Speirs Kirkland, M.B., Ch.M., F.R.A.C.S.; Bruce Atlee Hunt, M.D., B.S., M.R.C.P. (London); Douglas Reginald Gawler, M.B., B.Ch. (Oxford). Flight Lieutenant N. E. H. Box, M.B., B.S., D.L.O., F.R.C.S., F.R.A.C.S., is granted the honorary rank of Squadron Leader, 1st October, 1939. The following are transferred from the Active Force to the Reserve, 14th October, 1939: Squadron Leaders S. C. Steele, B.A., M.B., and G. P. Arnold, M.C., B.A., M.B., Ch.M.

Reserve: Medical Branch.

Wing Commander S. F. McDonald, M.D., B.S., M.R.C.P., is transferred from the Reserve to the Active Force, 1st October, 1939.—(Ex. Min. No. 341—Approved 27th October, 1939.)

Citizen Air Force.

Medical Branch.

Victor Ernest Knight, M.B., B.S., is granted a commission as Flight Lieutenant, 10th October, 1939. Stanley John Marcus Goulston, M.B., B.S., is granted a commission as Flight Lieutenant, 16th October, 1939. Edward Oswald Marks is granted a commission as Squadron Leader, 20th October, 1939.

Reserve: Medical Branch.

Flight Lieutenant K. C. Donovan, M.B., B.S., M.C.O.G., relinquishes his commission in the Reserve on being granted a commission in the Royal Air Force Volunteer Reserve, 17th September, 1939.—(Ex. Min. No. 346.—Approved 1st November, 1939.)

Ronald William Douglas Fisher, M.B., B.S., is granted a commission as Flight Lieutenant, 20th October, 1939.—(Ex. Min. No. 355—Approved 1st November, 1939.)

Correspondence.

HONORARIA.

Sir: It seems to me that the time has come when honorary work at public hospitals, especially the special hospitals, has become too much of a burden on the honorary staff and their assistants. Not being full teaching hospitals, little kudos is gained through serving in them, few students are contacted, and those few for a short time only, if at all. Further, one's colleagues are all more or less his competitors in practice, and nothing is gained from them except their good fellowship.

Clinical assistants serve usually just long enough to learn sufficient to help them in their general practices and then leave.

Money rules most things, and one wonders if Queensland has solved this problem by paying, I think, £3 10s. per session to full honoraries, £2 10s. to their assistants and £1 10s. to clinical assistants.

Yours, etc.,

October 23, 1939. "Honoraria."

OVARIAN RUPTURE CAUSING INTRAPERITONEAL HÆMORRHAGE.

Sir: I have read Dr. T. F. Rose's contribution to The Medical Journal of Australia, October 21, 1939, and I hope he will pardon me if I say that although he gives a voluminous bibliography, the only paper that explains these ovarian hæmorrhages is one not mentioned on his list.

Years ago, when I was piling up a long list of operations on ruptured tubal pregnancies and tubal abortions, there appeared a paper by John Sampson, of Albany, New York, which at once had two effects: the first was to convince me that some at least of the cases that I had entered under "tubal abortion" were not instances of that condition; and the second effect was to convince me that Sampson had written an epoch-making paper that threw a new light on some of the cases on which we had been putting the wrong tag.

Now, after reading Dr. Rose's paper, I would suggest to him that he should study Sampson's masterpiece; he will find it in *Surgery, Gynecology and Obstetrics*, March, 1924, and he will at once understand all about his own cases that have had ovarian ruptures, intraperitoneal hæmorrhage, tarry lutein cysts; in fact the whole bag of tricks he has described.

Briefly Sampson's discovery is this. He found that he had had 14 of 178 patients, which had been operated on for pelvic lesions, which had had certain ovarian cysts from two to four centimetres in diameter. Adhesions at times resulted from rupture of the ovarian cysts with discharge of their contents. The epithelial regeneration in some of these cysts was of the endometrial type, both in structure and function. Sampson suggested that the group represented the development of an endometrial cyst from the invasion of a follicular hæmatoma by misplaced endometrial epithelium. He brought forward abundant evidence that there was a direct implantation of the endometrium expressed from the Fallopian tubes on the peritoneal surfaces, whether this peritoneal surface was over the ovary or elsewhere.

This discovery of Sampson was of great interest to me, for, after acting as Lawson Tait's assistant and after seeing him so frequently operating in cases of ectopic pregnancy, I had visited many German clinics, and Veit, of Berlin (Veit of Bonn) had one day showed me a Fallopian tube with a half-extruded pregnancy that he had removed a year before. When I got back to London I brought a drawing of the tube to Bland Sutton, who was at that time (1892) claiming to be the first who had "dropped on" tubal abortion; but when I showed him Veit's drawing he had to admit that he had been forestalled. Lawson Tait did not take kindly to the term "tubal abortion", and he held that all tubal abortions were tubal ruptures.

Now where we all went wrong from time to time was that after operating in certain cases and finding hæmorrhage in connexion with the tube or the ovary we were too ready to claim that these cases were either instances of tubal rupture or tubal abortion. When Sampson published his paper it became obvious that some of the cases with abdominal hæmorrhage were due to tissue escaping through the mouth of the Fallopian tube into the peritoneal cavity, where it fell in suitable soil, including the ovary, and it there developed glands or tubules of endometrial type, which reacted to menstruation; and so we got such a case as Dr. Rose's third one, which he describes as an instance of "rupture of a tarry lutein cyst, with intraperitoneal hæmorrhage". He says "there was a small ruptured cyst in the right ovary, and blood was slowly oozing from the rent in the cyst. There was much clot in the cyst."

What had happened in this case was no doubt that an endometrial implant had taken place and it had invaded the ovary. As a result of the growth, combined with its reaction to menstruation, it developed into a hæmatoma and became one of "Sampson's hæmorrhagic menstruating or chocolate cysts of endometrial type".

Notice that Dr. Rose records that the attacks of pain in the right iliac fossa "were always worse when they occurred in the premenstrual period".

At the operation there was a small ruptured cyst in the right ovary and the blood was slowly oozing from the rent in the cyst. There was much clot in the cyst; some of that clot may have been left from a previous menstrual hæmorrhage.

Yours, etc.,

STEWART MCKAY.

Lismore,
New South Wales,
October 24, 1939.

Hospitals.

APPOINTMENTS AT THE ROYAL MELBOURNE HOSPITAL.

THE following decisions have been made by the committee of the Royal Melbourne Hospital in regard to the war service of medical officers:

1. That no new appointments to the Medical Staff or to the positions of Assistant Medical Officer, Associate Assistant or Dental Officer be made on a permanent basis during the period of the War or for a period of twelve months thereafter. Where it is necessary to make an appointment, it should be temporary and terminable within twelve months of the conclusion of hostilities. This shall not apply to vacancies occurring in the Medical Staff before 1st January, 1940.

2. That in each case where applicable, the period of war service of an "absentee" Honorary Officer be added to the age of retirement in respect of his hospital appointment at the discretion of the Committee of Management.

3. That in each case where applicable, hospital appointments of "absentee" Honorary Officers which would normally be terminated due to age limit be continued, the period of war service being added to the age limit in each case at the discretion of the Committee of Management.

4. The "age of retirement" in Clause (2) and the "age limit" in Clause (3) should be regarded as applying to both provisions laid down in By-Law 96, *i.e.*, retirement due to completion of 16 years' service, retirement of Specialists after 20 years' service or retirement on attaining the age of 60 years.

Obituary.

JAMES ADAM JOHNSTON MURRAY.

DR. J. MCF. ROSSELL has forwarded the following appreciation of the late Dr. James Adam Johnston Murray.

Dr. James Adam Johnston Murray is the last to pass on of those men who commenced the medical course at its inception at the Otago (New Zealand) University College. He proceeded from there to Edinburgh and graduated in the same year as Professor ("Jummy") Wilson. During the course he was a prosector under the tuition of Cunningham, of anatomy text-book fame.

After graduation he returned to New Zealand and practised at Kaipoi till early this century. In 1908 he started practice in Armidale, New South Wales, and remained there till 1919, when he transferred to Lindfield, New South Wales, and retired in 1934.

The many with whom he came in contact during these years in New Zealand, at Armidale, Lindfield and after retirement at Pymble will hold his memory dear. A gentle, kindly, modest Christian, he went about doing good and has left the world better for having lived in it.

He was active almost to the last and died quietly, as he would have wished, with relations in New Zealand, at the age of eighty-five. He is survived by two children, Mrs. Howell, in India, and Dr. Angus Murray, of Macquarie Street, Sydney.

HENRY HALE VOGLER.

WE regret to announce the death of Dr. Henry Hale Vogler, which occurred on November 7, 1939, at Cranbourne, Victoria.

GEORGE WILFRED LATIMER.

WE regret to announce the death of Dr. George Wilfred Latimer, which occurred on November 10, 1939, at Melbourne, Victoria.

AN AUSTRALIAN ARMY MEDICAL CORPS COMFORTS FUND FOR NEW SOUTH WALES.

THE wives and friends of the officers of the Australian Army Medical Corps (Eastern Command) have formed a regimental fund to be known as "The A.A.M.C. Comforts Fund". The object of this fund is to provide comforts

for the members of the Australian Army Medical Corps while on service in Australia or abroad, and already a number of auxiliaries have been formed in various suburbs of Sydney. Those interested in assisting this movement are invited to communicate with Mrs. R. Whiston Walsh (UJ 4727) or Mrs. S. H. Lovell (FW 5095).

Proceedings of the Australian Medical Boards.

QUEENSLAND.

THE undermentioned have been registered, pursuant to the provisions of *The Medical Acts*, 1925 to 1935, of Queensland, as duly qualified medical practitioners:

Boyd, George, L.R.C.P. and S. (Edinburgh), L.R.F.P.S. (Glasgow), 1935, Goondiwindi.

Petherbridge, Clyde Tyrer, M.B., B.S., 1938 (Univ. Sydney), Townsville.

Pope, Richard Alexander Dennistoun, M.B., Ch.B., B.A.O., 1923, M.D., 1925 (Univ. Dublin), Brisbane.

Books Received.

LECTURES ON THE ANÆMIAS AND VITAMIN DEFICIENCIES, DELIVERED IN MELBOURNE IN AUGUST, 1938, UNDER THE AUSPICES OF THE MELBOURNE PERMANENT POSTGRADUATE COMMITTEE, by W. B. Castle, M.D., S.M.; 1939. Melbourne: The Melbourne Permanent Postgraduate Committee. Crown 8vo, pp. 146.

Diary for the Month.

Nov. 21.—New South Wales Branch, B.M.A.: Ethics Committee.
Nov. 22.—Victorian Branch, B.M.A.: Council.
Nov. 23.—New South Wales Branch, B.M.A.: Clinical Meeting.
Nov. 24.—Queensland Branch, B.M.A.: Council.
Nov. 24.—Tasmanian Branch, B.M.A.: Council.
Nov. 28.—New South Wales Branch, B.M.A.: Medical Politics Committee.
Nov. 30.—South Australian Branch, B.M.A.: Branch.
Nov. 30.—New South Wales Branch, B.M.A.: Branch.
Dec. 5.—New South Wales Branch, B.M.A.: Executive and Finance Committee, Organization and Science Committee.
Dec. 6.—Western Australian Branch, B.M.A.: Council.
Dec. 7.—South Australian Branch, B.M.A.: Council.
Dec. 8.—Queensland Branch, B.M.A.: Annual Meeting.
Dec. 12.—New South Wales Branch, B.M.A.: Ethics Committee.
Dec. 12.—Tasmanian Branch, B.M.A.: Branch.
Dec. 14.—New South Wales Branch, B.M.A.: Branch.
Dec. 15.—Queensland Branch, B.M.A.: Council.

Medical Appointments.

Dr. F. E. Wall has been appointed a Member of the New South Wales Medical Board, in pursuance of the provisions of the *Medical Practitioners Act*, 1938-1939, of New South Wales.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser", pages xiv-xvi.

CHILDREN'S HOSPITAL (INC.), PERTH, WESTERN AUSTRALIA: Junior Resident Medical Officers.

IPSWICH HOSPITALS BOARD, IPSWICH, QUEENSLAND: Resident Medical Officer.

ST. GEORGE DISTRICT HOSPITAL, KOGARAH, NEW SOUTH WALES: Resident Medical Officers.

SYDNEY HOSPITAL, SYDNEY, NEW SOUTH WALES: Senior Resident Medical Officer.

THE WOMEN'S HOSPITAL, CROWN STREET, SYDNEY, NEW SOUTH WALES: Resident Medical Officers.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCHES.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	Associated Medical Services Limited. All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Federated Mutual Medical Benefit Society. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17.	Brisbane Associate Friendly Societies' Medical Institute. Proserpine District Hospital. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.
SOUTH AUSTRALIAN: Secretary, 175, North Terrace, Adelaide.	All Lodge appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth.	Wiluna Hospital. All Contract Practice Appointments in Western Australia.

Editorial Notices.

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